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ABSTRACT

This unit is designed to aid teachers in lesson planning in the secondary agricultural education curriculum in Missouri. Intended to be taught to ninth-grade students of vocational agriculture, the unit contains six lessons for developing competencies needed in poultry production. The lessons are as follows: (1) the importance of the poultry industry, (2) selection and evaluation of poultry, (3) feeding poultry, (4) housing and equipment for poultry, (5) maintaining flock health, and (6) marketing poultry and eggs. The unit is made up of the six lessons, unit objectives, competencies to be developed, motivational technique or interest approach, resources and references, evaluation techniques, and evaluation checklist. Lessons include lesson objectives, study questions, references, teaching procedures, information sheets, activities, competencies, evaluation, and answers to evaluation questions. (KC)



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MISSOURI AGRICULTURAL EDUCATION

AG-160-I
AGDEX 450/10

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# Poultry Production
Poultry Production
Poultry Production
Poultry Production

## For
## Agricultural Science I Core Curriculum
### Instructor's Guide

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In Cooperation with
Agricultural Education
Department of Practical Arts and Vocational Technical Education
College of Education and College of Agriculture
University of Missouri-Columbia

In Cooperation with
Agricultural Education Section
Division of Vocational and Adult Education
Department of Elementary and Secondary Education
Jefferson City, Missouri

Instructor's Guide

# POULTRY PRODUCTION

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Volume 19
Number 2

Produced by the Instructional Materials Laboratory
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ACKNOWLEDGMENTS

A new addition to the Agricultural Science I curriculum, this Poultry Production unit was developed according to suggestions made by the MVATA Teaching Aids Committee. Livestock and Poultry Production, fifth edition, by Bundy, Diggins, and Christensen is the student reference for this unit.

Special recognition is given to the Poultry Advisory Committee members for providing their valuable time and suggestions in developing this unit. The Poultry Advisory Committee consisted of the following persons: Doug Funk, Glenn Geiger, Terry Heiman, John Hobbs, Carl Pearcey, Mike Shafer, and Curtis Weston.

We especially thank Glenn Geiger, State Extension Poultry Specialist, for contributing his technical expertise and professional guidance at all stages in the development of this unit.

Special recognition is also due to Harley Schlichting, director of the Instructional Materials Laboratory and his staff for the typing, editing, and illustrating of this unit.

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# FOREWORD

Development of this Poultry Production unit was suggested by the MVATA Teaching Aids Committee. The Poultry Advisory Committee selected the topics to be included in this unit. All lessons are organized in a format designed to facilitate their use in the classroom. This unit was designed to be taught to ninth grade students of vocational agriculture.

Six lessons for developing competencies needed in poultry production make up this unit. The lessons are as follows: 1) The Importance of the Poultry Industry, 2) Selection and Evaluation of Poultry, 3) Feeding of Poultry, 4) Housing and Equipment for Poultry, 5) Maintaining Flock Health, and 6) Marketing Poultry and Eggs. Appropriate SOEP lessons should also be included along with this unit in your teaching calendar.

Livestock and Poultry Production, fifth edition, by Bundy, Diggins, and Christensen is the student reference for this unit. Additional references for the instructor have been provided with each lesson.

Bob R. Stewart, Professor and
Coordinator
Agricultural Education
University of Missouri-Columbia

Terry Heiman, Director
Agricultural Education
Department of Elementary and
Secondary Education

# POULTRY PRODUCTION

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AGRICULTURAL SCIENCE I

UNIT - POULTRY PRODUCTION

LESSONS

1. The Importance of the Poultry Industry
2. Selection and Evaluation of Poultry
3. Feeding of Poultry
4. Housing and Equipment for Poultry
5. Maintaining Flock Health
6. Marketing Poultry and Eggs

OBJECTIVES

1. The student will locate and describe the potential employment opportunities in major poultry production areas.
2. The student will evaluate classes of poultry for productivity and profitability.
3. The student will relate the nutritional needs of poultry to the internal anatomy and external environment of a bird.
4. The student will plan facilities according to space requirements and equipment needs for a poultry enterprise.
5. The student will explain the steps and health benefits of properly preparing and maintaining poultry facilities.
6. The student will describe the processes and important factors to consider in marketing poultry products.

NOTE: Percent of accuracy to be set by instructors to reflect passing grades within their school systems.

COMPETENCIES TO BE DEVELOPED

1. Describe the importance of the poultry industry.
2. Select and evaluate poultry.

3. Describe how to meet the nutritional needs of poultry.

4. Plan housing and equipment for raising poultry.

5. Describe procedures for promoting flock health and sanitation.

6. Describe various marketing channels for poultry and eggs.

MOTIVATIONAL TECHNIQUE OR INTEREST APPROACH

1. Ask the students if any of them have considered employment in the poultry industry upon graduating from high school.

2. Ask the students what kind of school or work experience would be valuable to a high school graduate seeking employment in the poultry industry.

3. Ask the students to imagine themselves as poultry producers. An understanding of which particular aspects of production could mean the difference between success and failure for their poultry operation?

REFERENCES AND MATERIALS

1. Student reference (required)

   a) Bundy, Diggins, and Christensen. Livestock and Poultry Production, 5th edition. Englewood Cliffs, NJ: Prentice-Hall Inc., 1982.

2. Teacher references

   NOTE: These are suggested references and materials. This does not imply that they all must be used. Using only the required student reference should be sufficient to successfully teach this unit.

   a) Texts

      1) Moreng and Avens. Poultry Science and Production. Reston, Va.: Reston Publishing Co. Inc., 1985.

      2) Neshiem, Austic, and Card. Poultry Production. Philadelphia, Pa.: Lea and Febiger, 1979.

b) Booklets


1) Lasley, Floyd A. "The U.S. Poultry Industry: Changing Economics and Structure," USDA Agricultural Economic Report No. 502. July 1983.

2) Bigbee, Dan E.; Joyce Jones; and Charles Wabeck. "Poultry Judging." West Lafayette, Ind.: Cooperative Extension Service, Purdue University.

3) "Classes, Breeds, and Varieties of Chickens and Turkeys," No. 8015. College Station, Texas: Vocational Instructional Services, Texas A & M University.*

4) "Selecting Poultry," No. 8016. College Station, Texas: Vocational Instructional Services, Texas A & M University.*

5) "External and Internal Parasites of Poultry," No. 8080. College Station, Texas: Vocational Instructional Services, Texas A & M Unversity.*

6) "Poultry Judging and Poultry and Egg Grading," No. 8083. College Station, Texas: Vocational Instructional Services, Texas A & M University.*

7) "Incubating Eggs of Domestic Birds," No. 530. Clemson, SC: Clemson University Cooperative Extension Service, March 1985.

   Available from Clemson University Cooperative Extension Service, Clemson, S.C. 29631

8) Lasley, Floyd A.; William L. Henson; and Harold B. Jones. "The U.S. Turkey Industry," USDA Agricultural Economic Report No. 525. March 1985.

9) Berg, Robert; and David Halverson. "The Turkey Management Guide." Minnesota Turkey Growers Association, 1985.

   Available from Minnesota Turkey Growers Association, 786 Transfer Road, St. Paul, Minn. 55114.

10) Arrington, Lewis C. "Small Turkey Flock Management," North Central Regional Extension Publication No. 60. January 1979.**

11) Arrington, Lewis C. "Market Turkey Management-Brooding," North Central Regional Extension Publication No. 115. October 1980.**

12) "Insect Control Recommendations." University of Missouri-Columbia Extension Division, 1985.**

c) Manuals

1) Missouri Farm Planning Handbook (Manual 75). UMC College of Agriculture-Extension Division, June 1981.

2) Salsbury Manual of Poultry Diseases, 7th edition. Charles City, Iowa: Salsbury Laboratories, Inc.

Available at Salsbury Laboratories Inc., Charles City, Iowa 50616-9989

d) University of Missouri-Columbia Extension Division Agricultural Guides**

1) 8790: Brooding and Rearing Turkeys

2) 8904: Control of Poultry Disease Outbreaks

3) 8906: Poultry Production and Marketing Contracts

4) 8908: Fumigation and Hatchery Sanitation

5) 8351: Brooding and Rearing Chicks for the Family Flock

6) 8450: Small Poultry Building

7) 8550: Sanitation Program for Quality Egg Producers

8) 8800: Turkey Breeder Management

e) Filmstrips/Slides***

1) "Small Flock Brooding Techniques" (F)

2) "Poultry Judging I and II" (F)

3) "Ready-to-Cook Poultry Carcass and Egg Quality" (S)

4) "Breeds and Varieties of Chickens" (S)

f) Addresses for Poultry Information

1) Poultry Science
Animal Science Research Center
University of Missouri-Columbia
Columbia, MO 65211

2) Missouri Poultry Industries Association
P. O. Box 995
Columbia, MO 65205

3) United States Department of Agriculture
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

4) American Agricultural Marketing Association
Affiliate of the American Farm Bureau Federation
225 Touhy Ave.
Park Ridge, IL 60068
312-399-5700

5) American Egg Board
1460 Renaissance Dr.
Park Ridge, IL 60068
312-296-7044

Administers the rules and regulations of the Egg Research and Promotion Order under the Egg Research and Consumer Information Act.

6) Midwest Egg Producers
Box K
Eldridge, IA

7) Midwest Poultry Federation
786 Transfer Rd.
St. Paul, MN 55114
614-646-4553

8) National Broiler Council
1155 15th St. NW
Washington, DC 20005
202-296-2622

Represents the producer-processors of more than 80 percent of the total United States broiler production.

9) The National Turkey Federation
Suite 302
Reston International Center
Reston, VA 22091
703-860-0120

Promotes turkey consumption, legislation, and research; distributes information about the turkey industry.

10) Poultry Breeders of America
1456 Church St.
Decatur, GA 30030
404-377-6465

Concerns are fostering and improving breeding stock in all segments of the poultry industry.

* Write to Vocational Instructional Services, Texas A & M University, College Station, Texas 77843.

** Write to Extension Publications, 115 Fifth St., Columbia, MO 65211.

*** May obtain on free loan basis from the Missouri Vocational Resource Center, 10 Industrial Education Building, University of Missouri-Columbia, Columbia, MO 65211 (800-392-7217 or out-of-state 314-882-2883).

EVALUATION

1. Give short, objective tests following each lesson and a more in-depth objective test at the conclusion of each unit.

2. Observe the changes in behavior as evidence of an improved ability of the students to deal with problems in this unit using background acquired from earlier units.

3. Observe students' attempts to solve similar problems in their supervised occupational experience programs.

## Poultry Production
## MAJOR COMPETENCY PROFILE

**Directions:** Evaluate the student by checking the appropriate number or letter to indicate the degree of competency. The rating for each task should reflect **employability readiness** rather than the grades given in class.

**Rating Scale:**
- 3 **Mastered** - can work independently with no supervision
- 2 **Requires Supervision** - can perform job completely with limited supervision
- 1 **Not Mastered** - requires instruction and close supervision
- N **No Exposure** - no experience or knowledge in this area

| 3 | 2 | 1 | N | |
|---|---|---|---|---|
| | | | | **Poultry Production** |
| | | | | 1. Describe the importance of the poultry industry. |
| | | | | 2. Select and evaluate poultry. |
| | | | | 3. Describe how to meet the nutritional needs of poultry. |
| | | | | 4. Plan housing and equipment for raising poultry. |
| | | | | 5. Describe procedures for promoting flock health and sanitation. |
| | | | | 6. Describe various marketing channels for poultry and eggs. |
| | | | | _____ |
| | | | | _____ |
| | | | | _____ |

# Poultry Production

Class/Section: _____

| STUDENTS: | 1. Describe the importance of the poultry industry. | 2. Select and evaluate poultry. | 3. Describe how to meet the nutritional needs of poultry. | 4. Plan housing and equipment for raising poultry. | 5. Describe procedures for promoting flock health and sanitation. | 6. Describe various marketing channels for poultry and eggs. | |
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UNIT - POULTRY PRODUCTION

Lesson 1: The Importance of the Poultry Industry

Objective: The student will locate and describe the potential employment opportunities in major poultry production areas.

Study Questions

1. **Which states lead in broiler, egg, and turkey production?**

2. **What are the major poultry enterprises?**

3. **What are some trends in poultry production and consumption?**

4. **What are the economic advantages in poultry production?**

5. **What are the career opportunities in the poultry industry?**

References

1. Livestock and Poultry Production, 5th edition, Bundy, Diggins and Christensen, Chapter 8, "Poultry Production," pages 525-533

2. Poultry Science and Production, Moreng and Avens, Chapter 1, "The Commercial Poultry Industry Related to Agricultural Food Production," pages 1-14 (optional)

3. Poultry Production, Neshiem, Austic and Card, Chapter 1, "The Poultry Industry," pages 1-15 (optional)

4. Missouri Farm Planning Handbook (Manual 75) (optional)

5. Handouts

   a) HO 1.1: Still-air Incubator
   b) HO 1.2: Candling Eggs
   c) HO 1.3: Incubator Period and Incubator Operation for Eggs for Domestic Birds
   d) HO 1.4: State Rankings in Poultry Production
   e) HO 1.5: Value of Poultry Production in Missouri and the United States

6. Transparency Masters

a) TM 1.1: Missouri's Major Poultry-Producing Counties for 1985-86
b) TM 1.2: Broiler Chickens and Turkeys: Production and Marketing Figures for 1985
c) TM 1.3: Eggs: Production and Marketing Figures for 1985

UNIT - POULTRY PRODUCTION

Lesson 1: The Importance of the Poultry Industry

TEACHING PROCEDURES

A. Introduction

Introduce the unit. Outline the lessons in the unit and discuss the competencies to be mastered.

B. Motivation

Bring up to six fertilized eggs to class and construct a simple bulb-heated incubator with the students. Ask the students how many days it will take for the eggs to hatch. Candle the eggs to identify the fertilized embryo and also candle them at intervals over the incubation period to note the progress of the developing chicks. (Refer to HO 1.1, HO 1.2 and HO 1.3.)

C. Assignment

D. Supervised Study

E. Discussion

1. Ask the students what type of climate would benefit poultry production and where in the United States this type of climate is found. Give HO 1.4 to the students and identify the leading states in poultry production in the United States. Show TM 1.1 to illustrate production in Missouri.

   NOTE: Keep HO 1.4 timely by requesting updated information from the UMC Poultry Science Department.

   **Which states lead in broiler, egg, and turkey production?**

   a) Broiler production - Arkansas, Georgia, Alabama, North Carolina and Mississippi supply a large portion of the broilers consumed in the United States.
   b) Egg production - California, Indiana, Georgia, Pennsylvania and Arkansas followed closely by Ohio, Texas and North Carolina are the states that lead in egg production.

c) Turkey production - North Carolina, Minnesota and California are the leading turkey-producing states in the United States, followed by Arkansas, Virginia and Missouri.

2. Ask the students the location of any local poultry enterprises and if they have visited or done business with the enterprise. Discuss how a community benefits from the presence of a poultry enterprise and, likewise, how the poultry enterprise benefits from a supportive community.

**What are the major poultry enterprises?**

a) Broiler production
b) Egg production
c) Turkey production
d) Ducks (in the Orient)
e) Pigeons, guinea fowl, geese (in many parts of the world)
f) Supporting industries
    1) Poultry equipment
        (a) Hatching
        (b) Brooding
        (c) Feeding
        (d) Processing
        (e) Packaging
    2) Poultry supplies
        (a) Feed
        (b) Medications
    3) Transportation
    4) Warehousing and refrigeration

3. Ask the students to estimate how many eggs they eat in one week and, after multiplying by 52 (number of weeks in a year), whether they meet the 1984 national average of 261. Give HO 1.5 to the students to illustrate Missouri's recent broiler, turkey and egg production.

**What are some trends in poultry production and consumption?**

a) The poultry industry in the United States started on family farms in the Midwest where grain production was concentrated.
b) The Southeast gained a competitive edge in the poultry industry because of the mild climate and vast pool of labor in that region.
c) Growth of the poultry industry is predicted to increase at a rate of 2 to 3 percent a year, to reach a destiny by 1990 when broilers would be the No. 1 meat by volume sold in the United States.

d) The turkey industry has changed from a bird production industry to a meat production industry and is much more extensively turning the whole carcass into specialized meat products.
   1) Boneless roasts
   2) Sausage
   3) Ham
   4) Ground meat
   5) Bologna
   6) Hot dogs
   7) Smoked specialty meats

e) Although per capita egg consumption has decreased since 1944, total egg consumption has remained quite steady as the United States population has increased.

NOTE: Use TM 1.1 and TM 1.2 to illustrate 1985 production figures for broilers, turkeys and eggs. Keep these TMs timely by requesting updated information from the UMC Poultry Science Department.

4. Along with the students, make some comparisons between the economics of poultry and livestock production. Write these comparisons on the chalkboard. Mention start-up capital, land utilization, turnover time of capital and market demands if these factors are not brought up in the discussion.

NOTE: See the reference Missouri Farm Planning Handbook (Manual 75) for more details on estimating costs and budgeting for poultry.

**What are the economic advantages in poultry production?**

a) Poultry production provides quick returns on the investment.
b) Poultry is efficient to produce.
c) Poultry income is distributed throughout the year.
d) Poultry production is adaptable to large and small farms.
e) The poultry industry provides for quick turnover of capital.
f) Poultry markets are standardized and well-established.
g) Poultry production may be a full-time or part-time occupation.

5. Ask the students what jobs available locally are connected to the poultry industry.

**What are the career opportunities in the poultry industry?**

a) Production
   1) Broilers
   2) Eggs
   3) Turkeys
   4) Hatching eggs
   5) Started, ready-to-lay pullets
b) Equipment suppliers
c) Hatcheries
d) Feed manufacturers
e) Processing plants
f) Packaging plants
g) Veterinary care
h) Transporters

F. Other Activities

1. Develop a list of potential SOE projects with poultry including raising, breeding and showing fowl and working in some area of the poultry industry.

2. Write the Missouri Poultry Industries Association (P.O. Box 995, Columbia, Mo. 65205) for any available literature pertaining to the poultry industry in Missouri.

3. Write regional and national poultry organizations for information on the poultry industry. (Addresses of such organizations are included in the reference section at the beginning of this unit.)

G. Conclusion

Emphasize the importance of the poultry industry in Missouri in relation to the economic benefits to the state economy as well as the nutritional benefits to consumers of poultry products throughout the state.

H. Competency

Describe the importance of the poultry industry.

I. Answers to Evaluation

1. a. Arkansas
   b. Georgia
   c. Alabama

2. North Carolina

3. Answers should include three of the following:

   Poultry equipment - for hatching, brooding, feeding, processing and packaging
   Poultry supplies - for feed and medications
   Transportation - transporting birds
   Warehousing and refrigeration - storing birds

4. Answers should include four of the following:

   boneless roasts, sausage, ham, ground meat, bologna, hot dogs, smoked specialty meats

5. a. quick
   b. efficient
   c. distributed
   d. quick
   e. well
   f. may be

6. a. Midwest
7. a. 1990
8. d. California, Indiana
9. a. 6th

UNIT - POULTRY PRODUCTION Name_____

Lesson 1: The Importance of the Poultry Industry Date_____

EVALUATION

Complete the following short answer questions.

1. List the top three states for broiler production in 1984.

   a.
   b.
   c.

2. The state which led all others in turkey production during 1985 was _____.

3. Certain industries are designed to support poultry enterprises. List three of these industries and briefly explain how each industry supports poultry enterprises.

   a.

   b.

   c.

4. List four specialized processed meat products made from turkey.

   a.
   b.
   c.
   d.

Circle the word or letter that corresponds to the best answer.

5. Complete the following statements.

   a. Poultry production provides (quick/slow) returns on an investment.
   b. Poultry is (inefficient/efficient) to produce.
   c. Poultry income is (distributed/not distributed) throughout the year.
   d. The poultry industry provides for (slow/quick) turnover of capital.
   e. Poultry markets are (well/poorly) established.
   f. Poultry production (may be/may not be) a part-time occupation.

6. In which region of the United States did the poultry industry originate?

   a. Midwest
   b. Southeast
   c. Southwest
   d. Northeast

7. Broiler meat is predicted to be the No. 1 meat sold by volume in the United States by the year _____.

   a. 1990
   b. 1995
   c. 2000
   d. 2010

8. Which pair of states led in egg production in 1984?

   a. Indiana, Pennsylvania
   b. Georgia, Arkansas
   c. Pennsylvania, Georgia
   d. California, Indiana

9. Which of the following was Missouri's rank among states in turkey production for 1985?

   a. 6th
   b. 2nd
   c. 8th
   d. 7th

## Still-air Incubator

The still-air incubator consists of a container with provisions for controlling heat, a supply of water to prevent the eggs from drying out and a slight amount of ventilation.

Construct the container from 1/2-inch waterproof plywood. A sheet of 2-foot x 4-foot will provide a box 12 inches x 12 inches x 16 inches. Heat is provided from two 40-watt light bulbs mounted in porcelain sockets. The amount of heat is controlled by a wafer-type thermostat with a snap-action switch. Sufficient humidity can be provided by a water-filled pan, which should be half the size of the floor area and should be placed in the bottom of the incubator.

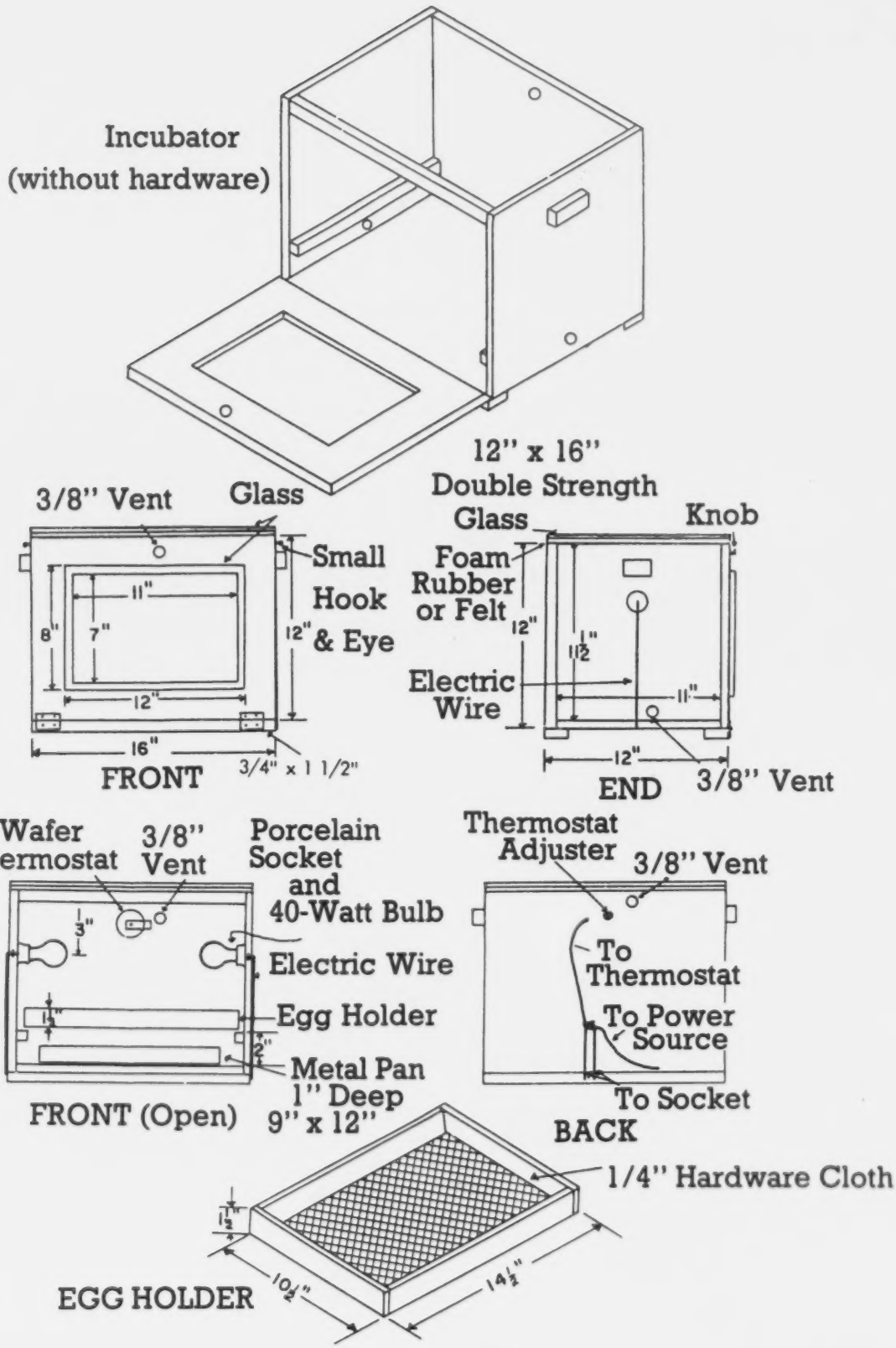
Properly ventilating the incubator is very important. There should be a 3/8-inch inlet at each end between the level at the eggs and the water pan. Two 3/8-inch outlets, one in the front door and one in the rear wall, should also be made. It is important to restrict one-half of the outlet by placing tape over half of the hole. When the first chick has hatched, remove the tape from both outlets. This will increase the rate of airflow.

All electrical contacts should be covered for safety. The porcelain sockets are wired in parallel, not series, so that each light will burn independently of the other.

**List of Materials**

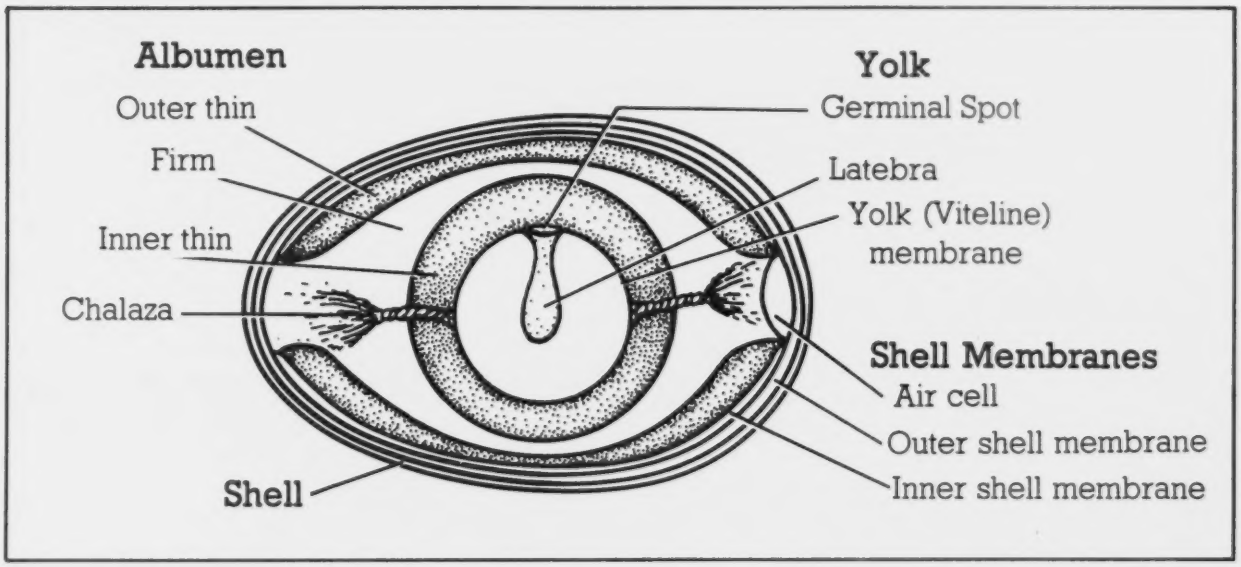
1 - 2-foot x 4-foot sheet exterior plywood
1 - 12-inch x 16-inch piece double-strength glass
1 - 8-inch x 12-inch piece double-strength glass
1 - 12-inch x 16-inch piece 1/4-inch hardware cloth
1 - pair small hinges
2 - hook and eye fasteners
2 - porcelain sockets
1 - wafer-type thermostat
1 - 12-foot lamp cord
1 - 9-inch x 11-inch x 1 1/2-inch cake pan
1 - Incubator thermometer
Miscellaneous nails, screws and tape
Foam rubber (1/4 inch x 1/2 inch) 56 running inches

Credit: Incubating Eggs of Domestic Birds, Clemson University Cooperative Extension Service, Clemson, SC, 1985, pages 12, 14, 15.


Incubator
(without hardware)
12" x 16"
Double Strength
Glass
3/8" Vent
Glass
Small
Hook
& Eye
11"
8"
7"
12"
12"
16"
3/4" x 1 1/2"
FRONT
Knob
Foam
Rubber
or Felt
12"
1 1/2"
Electric
Wire
11"
12"
END
3/8" Vent
Wafer
Thermostat
3/8"
Vent
Porcelain
Socket
and
40-Watt Bulb
3"
Electric Wire
Egg Holder
1 1/2"
2"
Metal Pan
1" Deep
9" x 12"
FRONT (Open)
Thermostat
Adjuster
3/8" Vent
To
Thermostat
To Power
Source
To Socket
BACK
1/4" Hardware Cloth
1 1/2"
10 1/2"
14 1/2"
EGG HOLDER

## Candling Eggs

Candling is used to judge interior egg quality. Although other factors help determine the grade of an egg, the interior quality is most important. Each egg is graded on its individual merits of quality according to USDA Grades. The grades are AA, A, B and Inedible. Knowledge of the parts of the egg is essential to understanding candling and grading. (See below.)




How to Candle

Hold the egg up to the candling light in a slanting position. You can see the air cell, the yolk and the white. The air cell is nearly always in the large end of the egg. Therefore, put the large end next to the candling light.

Hold the egg between your thumb and first two fingers. Then by turning your wrist quickly, you can cause the inside of the egg to whirl. This will tell you a great deal about the yolk and white. When you are learning to candle, you will find it helpful to break and observe any eggs you are in doubt about.

Credit: Poultry Judging, Purdue University Cooperative Extension Service, West Lafayette, IN, page 17

# Incubator Period and Incubator Operation for Eggs of Domestic Birds

| Requirements | Chicken and Bantam | Turkey | Duck[1] | Muscovy Duck | Goose | Guinea | Pheasant | Peafowl | Bobwhite Quail | Coturnix Quail | Chukar Partridge | Grouse | Pigeon |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Incubation Period (days) | 21 | 28 | 28 | 35-37 | 28-34 | 28 | 23-28 | 28-30 | 23-24 | 17 | 23-24 | 25 | 17 |
| Forced-Air Operating Temperature[2] (degrees F., dry bulb) | 99¾ | 99¼ | 99½ | 99½ | 99¼ | 99¾ | 99¾ | 99¼ | 99¾ | 99¾ | 99¾ | 99¾ | 99¾ |
| Humidity (degrees F., wet bulb) | 85-87 | 83-85 | 84-86 | 84-86 | 86-88 | 83-85 | 86-88 | 83-85 | 84-86 | 84-86 | 80-82 | 82-86 | 84-86 |
| Do Not Turn Eggs After | 19th day | 25th day | 25th day | 31st day | 25th day | 25th day | 21st day | 25th day | 21st day | 15th day | 21st day | 22nd day | 15th day |
| Operating Temperature During Last 3 Days of Incubation (degrees F., dry bulb) | 99 | 98½ | 98¾ | 98¾ | 98½ | 99 | 99 | 98½ | 99 | 99 | 99 | 99 | 99 |
| Humidity During Last 3 Days of Incubation (degrees F., wet bulb) | 90-94 | 90-94 | 90-94 | 90-94 | 90-94[3] | 90-94 | 92-95 | 90-94 | 90-94 | 90-94 | 90-94 | 90-94 | 90-94 |
| Open Ventilation Holes One-Fourth | 10th day | 14th day | 12th day | 15th day | 1st day | 14th day | 12th day | 14th day | 12th day | 8th day | 12th day | 12th day | 8th day |
| Open Ventilation Holes Further if Needed To Control Temperature | 18th day | 25th day | 25th day | 30th day | 25th day | 24th day | 20th day | 25th day | 20th day | 14th day | 20th day | 21st day | 14th day |

[1] It has been reported that duck eggs hatch better in still-air incubators than in forced-air incubators.

[2] For still-air incubators add 2-3°F. to the recommended operating temperatures.

[3] Better hatchability may be obtained if goose eggs are sprinkled with warm water or dipped in lukewarm water for half a minute each day during the last half of the incubation period.

Credit: Incubating Eggs of Domestic Birds, Clemson University Cooperative Extension Service, Clemson, SC, 1985, pages 8,9.

## State Rankings in Poultry Production

Missouri does not produce enough broilers to meet the needs of Missouri consumers. We consume more broilers than we produce. Likewise, Missouri does not produce quite enough eggs to meet the needs of Missouri consumers. However, Missouri produces a surplus of turkeys. U.S. per capita consumption of poultry in 1984 was as follows: 56 pounds of chicken, 261 eggs and 11.5 pounds of turkey.

Top 10 States - 1984
Broiler Production

| | | (1000 head) |
|---|---|---|
| 1. | Arkansas | 724,964 |
| 2. | Georgia | 636,785 |
| 3. | Alabama | 536,580 |
| 4. | North Carolina | 428,260 |
| 5. | Mississippi | 312,170 |
| 6. | Maryland | 271,168 |
| 7. | Texas | 200,500 |
| 8. | Delaware | 189,615 |
| 9. | California | 175.469 |
| 10. | Virginia | 148,829 |
| (16. | Missouri | 30,000) |

Top 10 States - 1985
Turkey Production

| | | (1000 head) |
|---|---|---|
| 1. | North Carolina | 32,650 |
| 2. | Minnesota | 30,800 |
| 3. | California | 20,350 |
| 4. | Arkansas | 15,000 |
| 5. | Virginia | 12,133 |
| *6. | Missouri | 12,000 |
| 7. | Pennsylvania | 6,700 |
| 8. | Indiana | 6,688 |
| 9. | Iowa | 6,300 |
| 10. | Wisconsin | 6,120 |

Top 10 States - 1984
Egg Production

| | | (million eggs) |
|---|---|---|
| 1. | California | 666 |
| 2. | Indiana | 459 |
| 3. | Pennsylvania | 417 |
| 4. | Georgia | 382 |
| 5. | Arkansas | 290 |
| 6. | Ohio | 283 |
| 7. | Texas | 276 |
| 8. | North Carolina | 267 |
| 9. | Alabama | 237 |
| 10. | Florida | 233 |
| (16. | Missouri | 116) |

Source: Glenn Geiger, State Extension Poultry Specialist

## Value of Poultry Production in Missouri and the United States

The figures listed below for value of production represent actual income to farmers. Besides production of broilers, eggs and turkeys, other sources of income in the Missouri poultry industry include poultry breeding, hatchery production (chicks and poults), started pullet production, water fowl and game bird production, and poultry processing.

| | Broilers (pounds produced) | Value of Production - 1984 |
|---|---|---|
| Missouri | 126,000,000 | $ 40,320,000 |
| United States | 17,854,788,000 | $ 6,014,528,000 |

| | Turkeys (pounds produced) | Value of Production - 1984 |
|---|---|---|
| Missouri | 225,600,000 | $ 103,776,000 |
| United States | 3,385,721,000 | $ 1,655,463,000 |

| | Eggs (number produced) | Value of Production - 1984 |
|---|---|---|
| Missouri | 1,357,000,000 | $ 68,981,000 |
| United States | 68,193,000,000 | $ 4,108,907,000 |

Total value of broilers, turkeys, and eggs produced in Missouri and the United States:

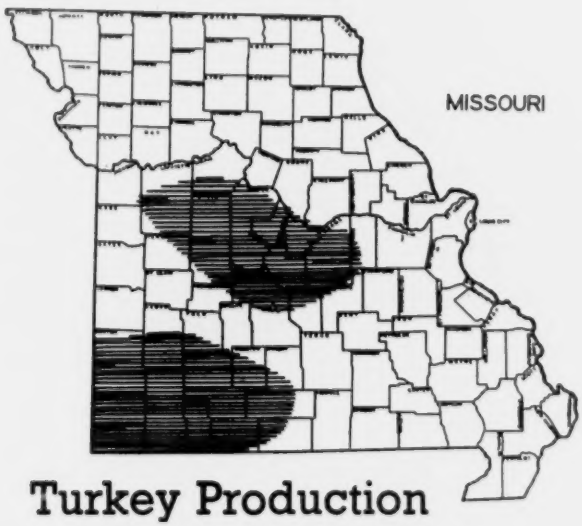
| | |
|---|---|
| Missouri | $ 213,077,000 |
| United States | $11,778,898,000 |

Source: Glenn Geiger, State Extension Poultry Specialist

# Missouri's Major Poultry-Producing Counties for 1985-86

Broiler Production

Shell Egg Production




Turkey Production

# Broiler Chickens and Turkeys: Production and Marketing Figures for 1985

| | Item | Broiler Chickens | Turkeys (hens and toms) |
|---|---|---|---|
| 1. | Time to marketing age | 7-8 wks. | 20 wks. |
| 2. | Average market weight<br>live weight | 4.2 lbs. | 21 lbs. |
| 3. | Feed conversion<br>lbs. of feed to produce one lb. live weight of meat | 2.1 lbs. | 3.1 lbs. |
| 4. | Total production cost per lb. live weight | 23¢ | 60¢ |
| 5. | Wholesale price<br>Ready-to-cook per lb. | 51¢ | 77¢ |
| 6. | Average retail price<br>Ready-to-cook per lb. | 76¢ | $1.05 |
| 7. | Price spread-<br>Price paid per pound by consumer minus price paid by retailer | 25¢ | 28¢ |

**Source:** Glenn Geiger, State Extension Poultry Specialist

# Major Marketing Channels For Eggs: Production and Marketing Figures for 1985

| | Item | |
|---|---|---|
| 1. | Average egg production per hen per year | 20.5 doz. |
| 2. | Feed conversion - lbs. of feed to produce one dozen eggs | 4.0 lbs. |
| 3. | Total production cost per one dozen eggs | 46¢ |
| 4. | Farm price per dozen table eggs | 50¢ |
| 5. | Wholesale price per dozen eggs - Grade A Large | 68¢ |
| 6. | Average retail price per dozen eggs - Grade A Large | 80¢ |
| 7. | Price spread - Price paid per dozen eggs by consumer minus price paid by retailer | 12¢ |

**Source:** Glenn Geiger, State Extension Poultry Specialist

UNIT - POULTRY PRODUCTION

Lesson 2: Selection and Evaluation of Poultry

Objective: The student will evaluate classes of poultry for productivity and profitability.

Study Questions

1. **How are chickens classified?**
2. **Which chicken breeds and crosses are used for egg and meat production?**
3. **How are live chickens and turkeys evaluated?**
4. **What is the culling criteria for the laying flock?**
5. **Why is sex determination important?**

References

1. Livestock and Poultry Production, 5th edition, Bundy, Diggins and Christensen, Chapter 35, "Selection of Chicks and Birds for Production," pages 534-548; and Chapter 38, "Turkey Production and Management," pages 582-583
2. Poultry Science and Production, Moreng and Avens, Chapter 4, "Genetics, Breeding, Culling, and Selection," pages 107-114 (optional)
3. Handout
   a) HO 2.1: Turkey Selection
4. Transparency Master
   a) TM 2.1: Parts of a Chicken
5. Audiovisual Materials
   a) Poultry Judging I and II (Filmstrips)
   b) Breeds and Varieties of Chickens (Slides)

UNIT - POULTRY PRODUCTION

Lesson 2: Selection and Evaluation of Poultry

TEACHING PROCEDURES

A. Review

Review the previous lesson.

B. Motivation

Bring a productive laying hen to class for the students to observe. Ask the students if they can identify the hen's breed. Ask what characteristics lead one to believe that the hen is indeed a productive layer.

C. Assignment

D. Supervised Study

E. Discussion

1. Brainstorm with the students on the different methods of classifying poultry and list these methods on the chalkboard. Emphasize that "classify" means to arrange something into groups according to established criteria.

**How are chickens classified?**

a) Chickens are classified as follows.
   1) Class
      (a) A class is a group of breeds originating in the same geographical area.
      (b) Four classes of chickens
         (1) Asiatic
         (2) Mediterranean
         (3) American
         (4) English
      (c) Two identifying characteristics of a class
         (1) Feathered or nonfeathered shanks
         (2) Egg color
   2) Breed
      (a) Breeds are subdivisions of a class.
      (b) Particular breeds possess a specific set of physical characteristics.
         (1) Body shape or type

(2) Skin color
(3) Carriage
(4) Number of toes

3) Variety
   (a) Varieties are subdivisions of a breed.
   (b) Varieties have identifying characteristics.
      (1) Plumage color
      (2) Comb type
      (3) Feather pattern
      (4) Presence of a beard and muffs

4) Strains - either of the following
   (a) Subdivisions of a breed or variety possessing common traits
   (b) Progeny of a systematic cross

2. Ask the students what possible advantages come from using crossbred chickens, as compared to purebred chickens, for meat and egg production.

**What chicken breeds and crosses are used for egg and meat production?**

a) The uses in the poultry industry made of the chicken breeds within their classes are as follows.

1) American class
   (a) Bred for both meat and egg production
   (b) Breeds most popular within this class
      (1) Plymouth Rock
      (2) Wyandotte
      (3) Rhode Island Red
      (4) New Hampshire
      (5) Jersey Black Giant

2) Mediterranean class
   (a) Bred primarily for egg production
   (b) Breeds most popular within this class
      (1) Leghorn
      (2) Minorca
      (3) Ancona

3) English class
   (a) Bred for their meat
   (b) Breeds in this class most often kept
      (1) Cornish
      (2) Australorp
      (3) Orpington

4) Asiatic class
   (a) Uncommon in the United States
   (b) Raised in other parts of the world largely for meat production

(c) Breeds with greatest popularity in this class
(1) Brahma
(2) Cochin
(3) Langshan

b) An estimated 90 percent of the chickens used for egg and meat production are crosses. Breeds most commonly used in crosses are as follows.
1) Single-comb White Leghorns - used for producing strain crosses and hybrids for eggs
2) White Rock - widely used as the female parent of crossbred broilers
3) White Cornish - males generally used on White Rock, New Hampshire or cross-mated females in broiler production

3. Producers look at similar characteristics of both chickens and turkeys when evaluating birds in a flock, replacement birds, or chicks and poults. Given that they had $1,000 to invest in chicks for a new laying hen operation, ask the students what information about the chicks they would want to know before making a purchase.

**How are chickens and turkeys evaluated?**

a) Chicks to replace the laying flock and for broiler production are evaluated on the following.
1) Source - Transporting chicks a shorter distance and replacing birds with ease in case of losses are advantages of buying chicks from local hatcheries of good reputation.
2) Time to order - Place an order well in advance of delivery or pickup. Early hatched chicks generally are most profitable.
3) Breeding and quality - Buy healthy chicks of desirable breeding.
(a) Cheap chicks may result in a loss in production.
(b) Buy chicks from Pullorum-free flocks.
(c) Check production records of the present stock.
4) Sex - Use to be made of the chicks determines the sex to buy.
5) Age - Losses usually occur during the first two weeks.
6) Price - Investing in high quality chicks brings in a better income than capital invested in poor quality chicks.

b) Chickens to be used for parent stock (broilers or layers) are evaluated on the following characteristics.

1) Broilers
   (a) Parent livability and feed consumption
   (b) Egg production and hatchability
   (c) Brooding and raising mortality
   (d) Broiler growth rate, feed conversion and carcass quality
   (e) Salable meat yield
   (f) Percentage grade-A broilers
   (g) Income over chick and feed cost per broiler

2) Layers
   (a) Parent livability and feed consumption
   (b) Egg production and hatchability
   (c) Brooding and raising mortality
   (d) Pullet growth rate and feed conversion
   (e) Body weight at 150 days
   (f) Age at 50 percent production
   (g) Egg size and quality
   (h) Eggs per pullet housed
   (i) Pounds of feed per dozen 24-ounce eggs
   (j) Laying house mortality
   (k) Body weight at 500 days
   (l) Income over chick and feed cost per pullet housed

c) Layers are evaluated according to the following criteria.

NOTE: Use TM 2.1 to illustrate the parts of a chicken to the students.

1) Condition of the comb and wattles - The comb of a layer is large, red and glossy. The wattles are large, bright red and warm.
2) Brightness of eyes - Good layers have large, prominent and bright eyes.
3) Body capacity - A large body is desirable.
4) Handling quality - A soft, pliable abdomen with little fat is desirable.
5) Condition of the vent - The vent of a good layer is large, moist and oblong.
6) Amount of pigment - Good layers lack pigment in the vent, eye ring, earlobe, beak and shanks.
7) Stage of molt - Good layers molt rapidly late in the fall.

8) Health and vigor - Good layers are well-developed in the body, have bright eyes and clear-cut faces, appear vigorous and active, and carry their bodies well.

d) Turkeys are evaluated on the following criteria.

NOTE: Use HO 2.1 to discuss turkey selection with the students.

1) Physical traits
   (a) Body type and conformation
   (b) Health and vigor
   (c) Livability
   (d) Early market finish
   (e) Rapid feathering
2) Reproductive traits
   (a) Egg production
   (b) Egg fertility
   (c) Egg hatchability

4. Ask the students how culling benefits the overall productivity of the laying flock.

**What is the culling criteria for the laying flock?**

Unproductive hens in the laying flock are culled when showing one or a combination of the following characteristics.

a) Hen - weak, sluggish, undersized, lacking body capacity
b) Comb and wattles - shrunken, dry, dull, pale, scaly
c) Eyes - sunken, listless
d) Vent - small, puckered, dry, round
e) Pubic bones - thick, hard, close together
f) Abdomen - contracted; firm; covered with thick, coarse skin
g) Pigmentation - yellow pigment in vent, eye ring, earlobe, beak, shanks
h) Molt - early, slow

5. Discuss methods of determining the sex of chicks with the students. What are distinguishing characteristics for both sexes of mature birds?

**Why is sex determination important?**

a) Producers want sexed birds to avoid cockerels of certain breeds (Leghorns) that are not profitable in a broiler flock.

b) Producers purchase three chicks for every pullet to be placed in the laying flock or purchase sexed birds.

F. Other Activities

1. Show the filmstrip "Poultry Judging," Parts I and II, available at the Missouri Vocational Resource Center, 10 Industrial Education Building, UMC.

2. Visit a local poultry breeding operation where students can observe living examples of poultry breeds.

3. Have the students develop an in-class bulletin board dedicated to the poultry industry in Missouri.

G. Conclusion

Outline some specific economic benefits enjoyed by the poultry producer who selects, evaluates and maintains a productive flock.

H. Competency

Select and evaluate poultry.

I. Answers to Evaluation

1. a. Asiatic
   b. Mediterranean
   c. American
   d. English

2. a. breed
   b. breed
   c. variety
   d. breed
   e. variety
   f. variety
   g. breed
   h. class

3. a. American
   b. Mediterranean
   c. English

4. Answers should include four of the following:

Source - The shorter the distance, the better it is.
Time to order - Early hatched chicks are desirable.
Breeding and quality - Healthy chicks of desirable breeding are best.
Sex - Use to be made of chicks determines sex to buy.
Age - Started chicks from two to four weeks old are desirable.
Price - Invest in high-quality rather than low-quality chicks.

5. a. 5
b. 2
c. 3
d. 1
e. 4

6. Answers should include four of the following:

Hen is weak, sluggish, undersized, lacking body capacity.
Comb and wattles are shrunken, dry, dull, pale, scaly.
Eyes are sunken, listless.
Vent is small, puckered, dry, round.
Pubic bones are thick, hard, close together.
Abdomen is contracted; firm; covered with thick, coarse skin.
Bird has pigment in vent, eye ring, earlobe, beak, shanks.
Bird molts early.

7. The producer may want to avoid cockerels of certain breeds that are not profitable in a broiler flock or else may be replacing for pullets in a laying flock.

8. a. Single-comb White Leghorns
b. White Rock
c. White Cornish

UNIT - POULTRY PRODUCTION

Name_____

Lesson 2: Selection and Evaluation of Poultry

Date_____

EVALUATION

1. List the four chicken classes.

   a.
   b.
   c.
   d.

2. Write "class," "breed" or "variety" in the spaces provided to indicate whether the characteristics listed below are used to identify a chicken by class, breed or variety.

   a._____ body shape or type
   b._____ skin color
   c._____ comb type
   d._____ carriage
   e._____ plumage color
   f._____ presence of beard and muffs
   g._____ number of toes
   h._____ feathered or nonfeathered shanks

3. Complete the following statements by writing the name of the appropriate chicken class in the spaces provided.

   a. The chicken class bred for both meat and egg production is the _____ class.
   b. The chicken class bred primarily for egg production is the _____ class.
   c. The chicken class bred primarily for meat production is the _____ class.

4. List four factors for which chicks are evaluated. Beside each factor, briefly explain why chicks are evaluated for that factor.

   a.

   b.

   c.

   d.

5. Column A contains descriptions of parts of a good layer. Column B contains parts of a good layer. Select the part in Column B that matches the description in Column A. Place the number of the best choice in the space provided beside each description.

| A | | B | |
|---|---|---|---|
| a._____ | large, moist and oblong | 1. | eyes |
| b._____ | soft, pliable | 2. | abdomen |
| c._____ | large, red and glossy | 3. | comb |
| d._____ | large, prominent and bright | 4. | wattles |
| e._____ | large, bright red and warm | 5. | vent |

6. List four of the characteristics to look for when culling hens from a laying flock.

a.
b.
c.
d.

7. Briefly explain one reason why poultry producers purchase sexed chicks.

8. Complete the following statements by circling the chicken breed used in the crosses described.

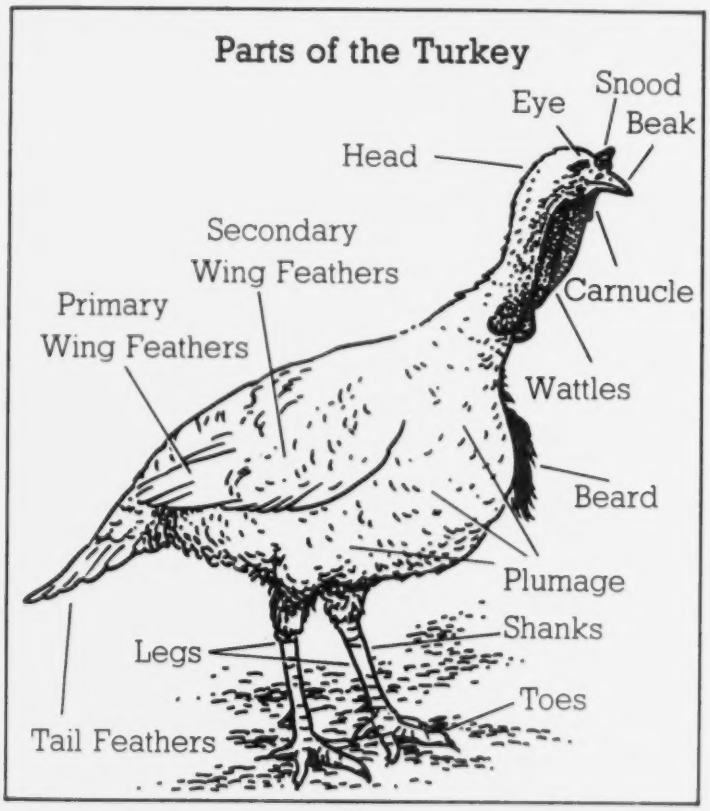
a. The chicken breed used for producing strain crosses and hybrids for eggs is the (White Rock/Single-comb White Leghorn).
b. The breed widely used as the female parent of crossbred broilers is the (White Cornish/White Rock).
c. Males generally used on White Rock, New Hampshire or cross-mated females for broiler production are of the (White Rock/White Cornish) breed.

# Turkey Selection

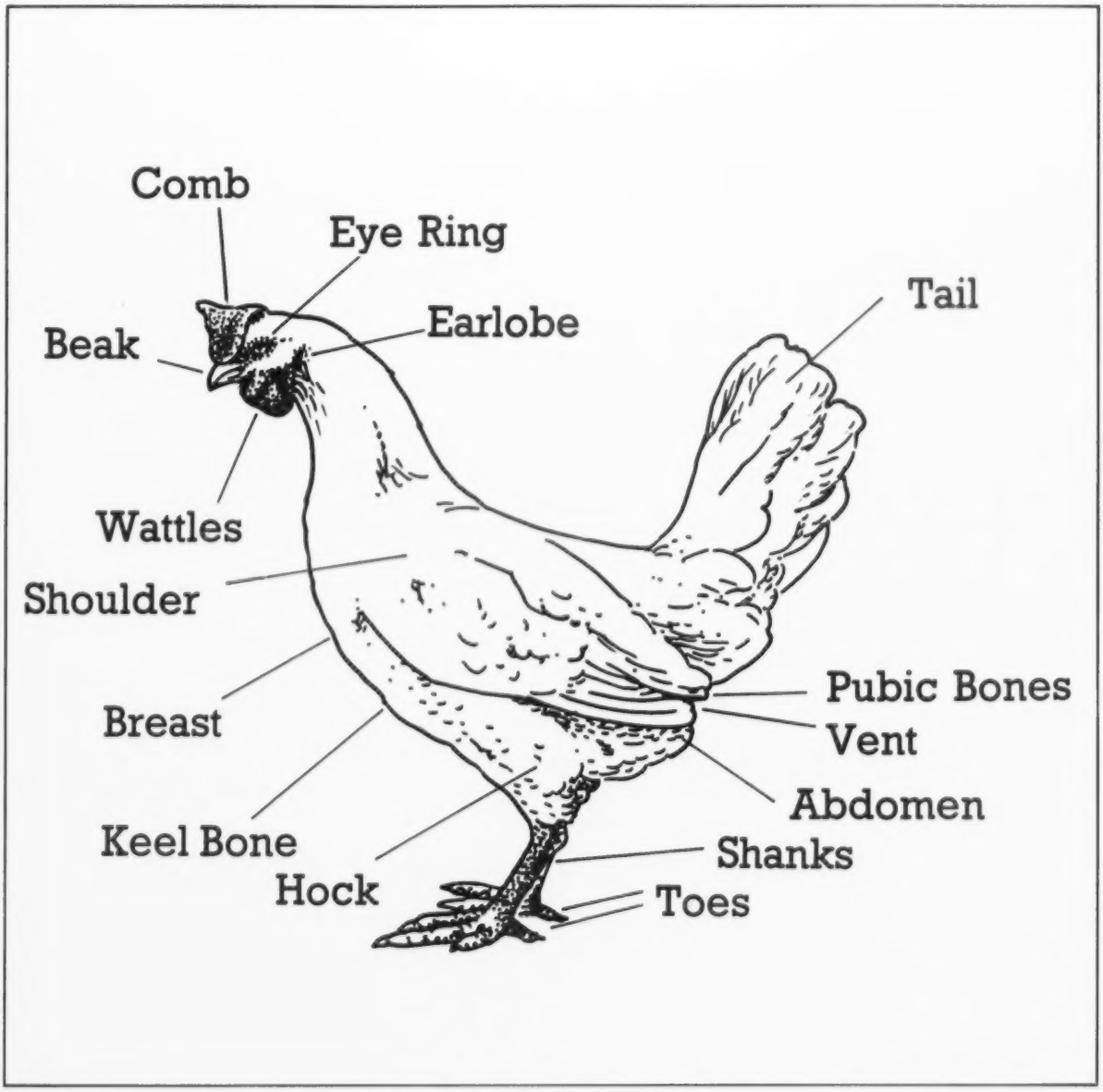
Turkeys are one of the few species of poultry native to North America. Although only one breed of turkeys is recognized by the American Standard of Perfection, there are about 14 known, standard-bred varieties within the breed.

Two commercially important turkey varieties in Missouri are the Beltsville Small White and the Broad Breasted White. Both varieties have pure white plumage. Standard weights for the Beltsville Small White tom and hen, respectively, are 12-17 lbs. and 7-10 lbs. The turkey tom and hen of the Broad Breasted White variety have standard weights of 25-28 lbs. and 15-16 lbs., respectively.

Although the selection of a turkey variety is largely determined by the intended market, the selection of a breeding stock is based on a number of economic factors. Some physical traits of economic importance to be considered at selection time are **body type** and **conformation**, **health** and **vigor**, **livability**, **early market finish** and **rapid feathering**. Important reproductive traits include **egg production**, **fertility** and **hatchability**.



# Parts of a Chicken



UNIT - POULTRY PRODUCTION

Lesson 3: Feeding of Poultry

Objective: The student will relate the nutritional needs of poultry to the internal anatomy and external environment of a bird.

Study Questions

1. **What characteristics of a bird's anatomy are different from that of other animals?**

2. **What are the digestive processes of poultry?**

3. **What are the major nutritional needs of poultry?**

4. **What are the major ingredients in a poultry ration?**

5. **What are some factors which affect feed consumption?**

6. **What are some methods of preventing cannibalism?**

References

1. Livestock and Poultry Production, 5th edition, Bundy, Diggins and Christensen, Chapter 36, "Feeding and Management of the Laying Flock," pages 549-566; and Chapter 37, "Feeding and Management of Young Chickens," pages 567-580

2. Poultry Science and Production, Moreng and Avens, Chapter 3, "Avian Anatomy and Physiology," pages 47-84 (optional)

3. Poultry Production, Nesheim, Austic and Card, Chapter 8, "Feed Ingredients," pages 218-231; and Chapter 9, "The Nutrient Requirements of Poultry," pages 232-252 (optional)

4. Handouts

   a) HO 3.1: Avian Anatomy
   b) HO 3.2: Digestive System of a Chicken

UNIT - POULTRY PRODUCTION

Lesson 3: Feeding of Poultry

TEACHING PROCEDURES

A. Review

Review the previous lesson.

B. Motivation

Compare samples of starter mash and grower pellets with the students. Ask the students why the texture of the types of feed is different and what similarities and differences appear on the label of ingredients for each.

C. Assignment

D. Supervised Study

E. Discussion

1. Air-filled sacs in certain avian bones are one characteristic of birds enabling them to fly. Drop two rolled paper cylinders (1-inch diameter) from eye level to show the students that they strike the floor simultaneously. Then, crumple a sheet of paper and insert it into one of the cylinders. Which cylinder will strike the ground first? (HO 3.1)

**What characteristics of a bird's anatomy are different from that of other animals?**

a) Feathers - All birds have feathers, something no other animals have.
   1) Major functions of feathers
      (a) Provide protection from the elements
      (b) Help regulate body temperature
      (c) Streamline the body for flight
   2) Types of feathers
      (a) Quill - long wing and tail feathers
      (b) Contour - shapely outer feathers
      (c) Plumule - fluffy, insulating feathers next to the body
      (d) Filoplume - hairlike feathers close to the body

b) Avian skeleton - A bird's skeleton is adapted for flight and is different from other animals' skeletons.

1) Fewer bones
2) Many fused bones
3) Higher mineral content in bones
4) Some bones filled with air instead of marrow

c) Urinary system - Waste products of metabolism in birds are excreted as solids into the large intestine.

d) Respiratory system - Birds have no diaphragm that functions in breathing.
   1) Muscular action in the abdomen and wings allows birds to breathe.
   2) Birds "air cool" their internal organs and muscles with the air sacs connected to their lungs.

e) Avian heart - A bird's heart is larger in size in relation to its body, beats faster and pumps more blood per unit of time than the heart of most other animals.

f) Reproductive system - Embryonic development of birds takes place outside of the body.
   1) Egg contents - all of the necessary components for the maintenance of life processes during embryonic development
   2) Egg shell - strong, durable "package" for the egg contents

2. Ask the students to explain the purpose of digestion. Remember that digestion is the process of making food absorbable by breaking it down into simpler chemical compounds. (HO 3.2)

**What are the digestive processes of poultry?**

a) Intake
   1) Beak - used for grasping, tearing and scooping food
   2) Tongue - has backward-pointing barbs for moving food backwards
   3) Esophagus - transports food to the stomach

b) Storage - An area for storing hastily consumed food is provided by the crop.

c) Digestion and nutrient absorption
   1) Proventriculus - "glandular stomach" where the first digestive juices are secreted
   2) Gizzard - "muscular stomach" for grinding and mixing food
   3) Small intestine - more mixing
      (a) Location of protein, carbohydrate and fat breakdown
      (b) Length of 4 to 5 feet in chickens
   4) Ceca - two pouches at the end of the small intestine for the breakdown of fiber

UNIT - POULTRY PRODUCTION

Lesson 3: Feeding of Poultry

TEACHING PROCEDURES

A. Review

Review the previous lesson.

B. Motivation

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      (c) Streamline the body for flight
   2) Types of feathers
      (a) Quill - long wing and tail feathers
      (b) Contour - shapely outer feathers
      (c) Plumule - fluffy, insulating feathers next to the body
      (d) Filoplume - hairlike feathers close to the body

b) Avian skeleton - A bird's skeleton is adapted for flight and is different from other animals' skeletons.

1) Fewer bones
2) Many fused bones
3) Higher mineral content in bones
4) Some bones filled with air instead of marrow

c) Urinary system - Waste products of metabolism in birds are excreted as solids into the large intestine.

d) Respiratory system - Birds have no diaphragm that functions in breathing.
   1) Muscular action in the abdomen and wings allows birds to breathe.
   2) Birds "air cool" their internal organs and muscles with the air sacs connected to their lungs.

e) Avian heart - A bird's heart is larger in size in relation to its body, beats faster and pumps more blood per unit of time than the heart of most other animals.

f) Reproductive system - Embryonic development of birds takes place outside of the body.
   1) Egg contents - all of the necessary components for the maintenance of life processes during embryonic development
   2) Egg shell - strong, durable "package" for the egg contents

2. Ask the students to explain the purpose of digestion. Remember that digestion is the process of making food absorbable by breaking it down into simpler chemical compounds. (HO 3.2)

**What are the digestive processes of poultry?**

a) Intake
   1) Beak - used for grasping, tearing and scooping food
   2) Tongue - has backward-pointing barbs for moving food backwards
   3) Esophagus - transports food to the stomach

b) Storage - An area for storing hastily consumed food is provided by the crop.

c) Digestion and nutrient absorption
   1) Proventriculus - "glandular stomach" where the first digestive juices are secreted
   2) Gizzard - "muscular stomach" for grinding and mixing food
   3) Small intestine - more mixing
      (a) Location of protein, carbohydrate and fat breakdown
      (b) Length of 4 to 5 feet in chickens
   4) Ceca - two pouches at the end of the small intestine for the breakdown of fiber

d) Waste elimination
    1) Large intestine - for storing undigested waste material and for reabsorbing water from the waste
    2) Cloaca - common chamber into which the digestive, urinary and reproductive tracts open
    3) Vent - opening at the posterior end of the bird

3. Emphasize that an understanding of the avian digestive system is important in understanding why poultry require highly specialized diets that are low in fiber, contain all the necessary nutrients in adequate amounts, and also are easily digested.

**What are the major nutritional needs of poultry?**

a) Carbohydrates and fats - for body heat and energy
    1) Grains used to provide carbohydrates and fats are corn, oats, barley, wheat and grain sorghum
    2) Availability, price and quality determine grains to be fed.
b) Proteins - provide the essential amino acids
    1) Animal sources of protein used in poultry rations are skim milk, butter milk, meat scraps and fish meal.
    2) Plant sources used include soybean meal, corn gluten and peanuts.
c) Fiber - essential for maximum growth and productivity (Grains and legume hays provide fiber.)
d) Minerals - calcium, phosphorous, salt and grit
e) Vitamins - essential in small quantities
f) Water - permits normal body processes

4. Ask the students if any one of them has ever mixed a poultry ration. Then ask what ingredients go into the mixture.

**What are the major ingredients in a poultry ration?**

a) Ground yellow corn or grain sorghum
b) Pulverized oats
c) Soybean meal
d) Wheat middling or grain wheat
e) Meat and bone scraps
f) Whole fish meal
g) Dried whey or distillers dried solubles
h) Dehydrated alfalfa meal
i) Defluorinated rock phosphate

j) Feeding limestone
k) Iodized salt
l) Stabilized feed-grade fat

NOTE: See the reference, Poultry Production, chapters 7-9 for more information on poultry nutrition and feed ingredients.

5. Small breeds of hens, such as Leghorns, are popular in commercial egg production because they can efficiently convert feed into eggs. Ask the students why such efficiency is not also characteristic of the larger breeds.

**What are some of the factors which affect feed consumption?**

a) Breed
b) Body size
    1) Small breeds need less feed.
    2) Large breeds require extra feed for body maintenance.
c) Egg production rate (laying hens)
    1) Approximately one-fourth of the feed consumed by a hen is used for egg production.
    2) Approximately 1 pound of feed is required by a hen to produce seven eggs.
d) Environment
e) Age (chicks and broilers)

6. Ask the students whether cannibalism is more likely to be a problem for confined flocks or for flocks on the range. Then ask for reasons in support of the response.

**What are some methods of preventing cannibalism?**

a) Avoid crowding.
b) Feed finely ground oats to young chicks.
c) Include salt for a few days as 4 percent of the ash for chicks.
d) Remove injured and crippled chicks from the flock.
e) Avoid overheating.
f) Trim off one-half to two-thirds of the upper beak.
g) Purchase metal or plastic specs and attach them to the pullets' beaks when they are placed in the laying house.
h) Allow plenty of feeder space.
i) Provide good ventilation.
j) Feed fresh, green feeds or dry, green alfalfa hay.
k) Feed whole oats to growing pullets and laying hens.

l) Darken the windows and nests.
m) Delouse the birds and disinfect the quarters.

F. Other Activities

1. Prepare a chicken skeleton (see Appendix 2 of Poultry Science and Production) to illustrate poultry anatomy.

2. Beak-trim chicks, poults or pullets as a classroom demonstration.

3. Visit a local poultry-feed-producing enterprise to observe the processes and note the ingredients that go into feed for poultry.

G. Conclusion

Reinforce the idea that feeding poultry is an exacting science which requires producers to understand the nutritional needs of poultry and also be able to solve feeding problems as they arise in the operation.

H. Competency

Describe how to meet the nutritional needs of poultry.

I. Answers to Evaluation

1. a. 3
b. 2
c. 4
d. 1

2. a. fewer
b. many
c. higher
d. air

3. Air sacs connected to a bird's lungs "air cool" internal organs.

4. a. Intake
b. Storage
c. Digestion and nutrient absorption
d. Waste elimination

5. Answers should include four of the following:

Breed
Body size
Egg production rate
Environment
Age

6. a. 6
b. 5
c. 11
d. 1
e. 9
f. 3
g. 10
h. 4

7. Answers should include six of the following:

Avoid crowding.
Feed finely ground oats to chicks.
Include salt for a few days as 4 percent of the mash for chicks.
Remove injured and crippled chicks from the flock.
Avoid overheating.
Trim off one-half to two-thirds of the upper beak.
Attach metal or plastic specs to beaks of pullets being placed in the laying house.
Allow plenty of feeder space.
Provide proper ventilation.
Feed fresh green feeds or dry green alfalfa.
Feed whole oats to growing pullets and laying hens.
Darken the windows and nests.
Delouse the birds and disinfect the quarters.

8. a. carbohydrates, fats
b. availability
c. protein
d. small
e. water

UNIT - POULTRY PRODUCTION Name_____

Lesson 3: Feeding of Poultry Date_____

EVALUATION

1. Match the feather type in column A to its matching description in column B. Place the numbers of your choices in the space provided beside each feather type.

| A | | B | |
|---|---|---|---|
| a._____ | quill | 1. | hairlike feathers close to the body |
| b._____ | contour | 2. | shapely outer feathers |
| c._____ | plumule | 3. | long wing and tail feathers |
| d._____ | filoplume | 4. | fluffy, insulating feathers next to the body |

2. In the parentheses, circle the word in each of the four sentence endings that correctly completes the following comparison.

   A bird's skeleton differs from an animal's in that it has _____

   a. (fewer/more) bones.
   b. (less/many) fused bones.
   c. (higher/lower) mineral content in bones.
   d. Some bones filled with (air/water) instead of marrow.

3. Briefly explain how birds cool their internal organs.

4. List the four digestive processes of poultry.

   a.
   b.
   c.
   d.

5. List four factors which affect feed consumption in poultry.

   a.
   b.
   c.
   d.

6. Column A contains descriptions of the parts of a bird's digestive system. Column B contains the parts of a bird's digestive system. Select the part in column B that matches the description in column A. Place the numbers of your choice in the space provided beside each description.

| | A | B |
|---|---|---|
| a._____ | muscular stomach | 1. beak |
| b._____ | glandular stomach | 2. tongue |
| c._____ | opening at the posterior end of a bird | 3. esophagus<br>4. crop |
| d._____ | used for grasping, tearing and scooping food | 5. proventriculus<br>6. gizzard |
| e._____ | for storing undigested waste material and for reabsorbing water from waste | 7. small intestine<br>8. ceca<br>9. large intestine |
| f._____ | transports food to the stomach | 10. cloaca<br>11. vent |
| g._____ | common chamber into which the digestive, urinary and reproductive tracts open | |
| h._____ | provides a storage area for hastily consumed food | |

7. List six methods of preventing cannibalism in poultry.

a.

b.

c.

d.

e.

f.

8. Complete the following statements concerning a poultry ration by writing the appropriate word or words in the blanks provided.

a. Corn, oats, barley, wheat and grain sorghum are grains used to provide _____ and _____.
b. Determining factors for grains to be fed to poultry are price, quality and _____.
c. Meat scraps and fish meal are two ingredients for providing _____.
d. Vitamins are essential in _____ quantities.
e. The ingredient which permits normal body processes is _____.

## Avian Anatomy

All birds have feathers, something no other animals have. The major functions of feathers are to protect the bird from the elements (wind, rain, etc.), to help regulate the bird's temperature and to streamline the bird's body for flight. The long feathers of the wing and tail are the quill feathers. Contour feathers provide shape to the wings and body. Lying next to the body, plumule feathers provide the bird with a fluffy insulation. Hairlike feathers also located close to the bird's body are the filoplume feathers.

Especially adapted for flight, the avian skeleton differs from that of other animals in that it has 1) fewer bones, 2) many fused bones, 3) bones having a higher mineral content and 4) some bones filled with air instead of marrow. These adaptive changes in the skeletal system of the bird have increased its strength and reduced its weight.

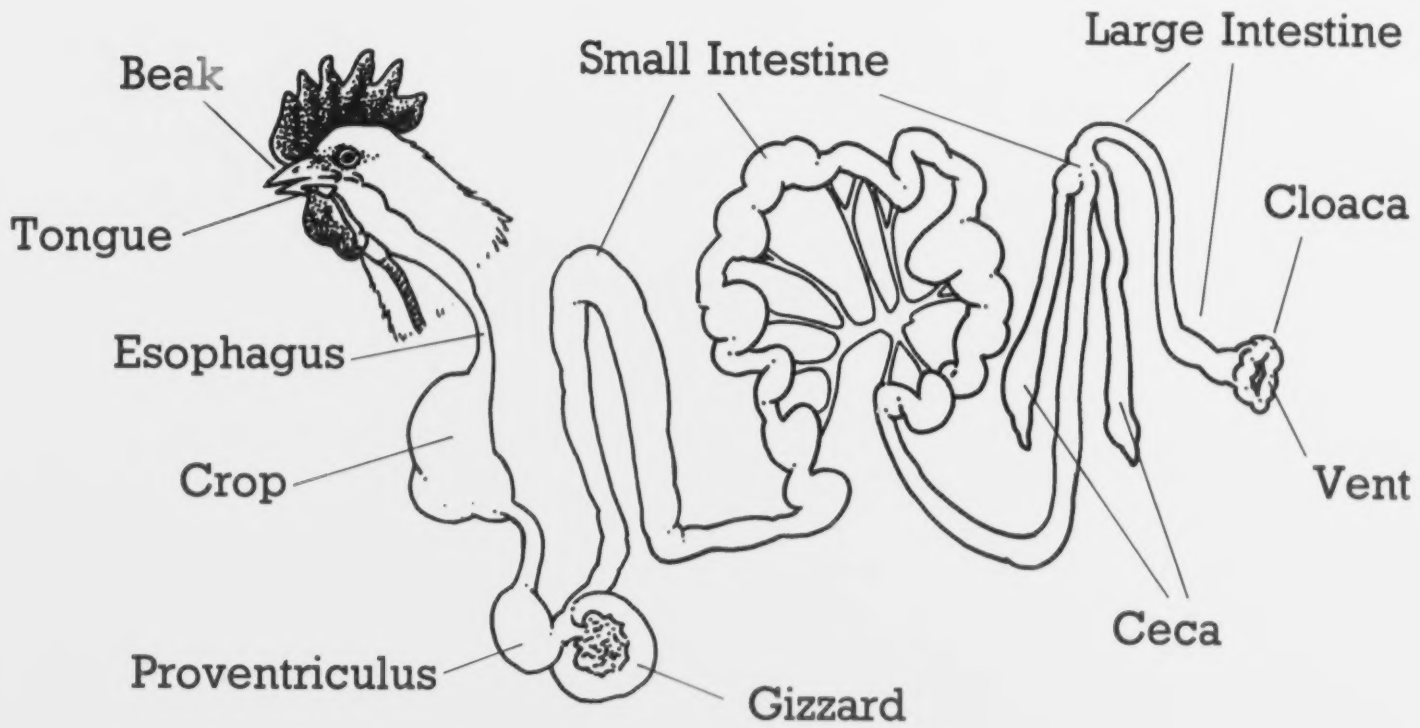
Birds have no urinary bladder and thus do not produce a watery urine as do other animals. Instead, birds excrete waste products of metabolism from their urinary system as solids into the large intestine. The respiratory system of birds is also unique in that birds have no diaphragm that functions in breathing. Birds breath with the help of muscular action in their abdomen and wings. Birds also "air cool" their internal organs and muscles with the air sacs connected to their lungs.

The avian heart is larger in relation to body size, beats faster and pumps more blood per unit of time than the heart of most animals.

Another unique feature of avian anatomy is the reproductive system. Embryonic development of birds takes place in an egg outside of the female bird's body. All components necessary for the maintenance of life processes during embryonic development are contained within the egg. The egg shell provides a strong and durable "package" for the developing egg.

Credit: Moreng and Avens. Poultry Science and Production.

# Digestive System of a Chicken




A chicken digests its food in four separate stages. These stages are as follows:

1. Intake
2. Storage
3. Digestion and nutrient absorption
4. Waste elimination

**Source:** Moreng and Avens, *Poultry Science and Production*, Fort Collins, CO: Department of Animal Science, Colorado State University, 1985, p. 61

UNIT - POULTRY PRODUCTION

Lesson 4: Housing and Equipment for Poultry

Objective: The student will plan facilities according to space requirements and equipment needs for a poultry enterprise.

Study Questions

1. **What are the basic types of poultry housing?**
2. **What are the space requirements for birds of different ages?**
3. **What are the key factors to consider when planning a brooding, grower or laying house?**
4. **What are the options when selecting equipment for a poultry operation?**

References

1. Livestock and Poultry Production, 5th edition, Bundy, Diggins, and Christensen, Chapter 36, "Feeding and Management of the Laying Flock," pages 552-559; Chapter 37, "Feeding and Management of Young Chickens," pages 567-570; and Chapter 38, "Turkey Production and Management," pages 583-586
2. Poultry Science and Production, Moreng and Avens, Chapter 6, "Brooding, Rearing, Housing and Equipment, and Production of Poultry," pages 146-190 (optional)
3. Poultry Production, Nesheim, Austic and Card, Chapter 6, "Houses and Equipment," pages 146-190 (optional)
4. Handout
   a) HO 4.1: Housing for Turkeys
5. Filmstrip
   a) "Small Flock Brooding Techniques"

UNIT - POULTRY PRODUCTION

Lesson 4: Housing and Equipment for Poultry

TEACHING PROCEDURES

A. Review

Review the previous lesson.

B. Motivation

Bring a laying cage to class and ask the students how many hens the cage can accommodate. Ask the students to estimate the space a caged hen requires. Calculate with the students the volume of the cage and compare that amount to the estimate.

C. Assignment

D. Supervised Study

E. Discussion

1. Birds have a greater ratio of body area to body volume than do most other animals. How do the feathers covering a bird's body protect it from exposure?

   **What are the basic types of poultry housing?**

   a) Laying houses
      1) Cage system of management
      2) Floor system of management
   b) Brooding houses - for brooding chicks
   c) Grower houses - to grow out broilers and replacements

2. Ask the students why a brooder guard is used to keep chicks in the general area of the hover. Why is space provided just beyond the hover limits?

   **What are the space requirements for birds of different ages?**

   a) Chicks
      1) First month - three-fourths of a square foot of floor space and 7 to 9 square inches of hover space
      2) After the first month - 1 square foot

b) Broilers
   1) Seven-tenths to eight-tenths square feet of floor space in the winter
   2) One square foot recommended in the summer

c) Layers
   1) Caged
      (a) Three birds per cage is recommended.
      (b) Each bird should have 54 to 64 square inches of cage space.
   2) Floor
      (a) For the light breeds provide 1 1/2 to 2 square feet of floor space for each bird.
      (b) For the heavy breeds provide 2 1/2 to 3 square feet of floor space or more for each bird. (Provide 1 1/2 square feet per bird for the heavy breeds under the following conditions.)
         (1) Feeders and waterers are placed in the roost area.
         (2) Hens are beak-trimmed to control cannibalism.
         (3) Birds are provided with adequate feeder space and rations.

d) Turkey hens (three-stage program)
   1) 0 - 5.5 weeks - 0.6 sq. ft. per bird
   2) 5.5 - 11 weeks - 1.2 sq. ft. per bird
   3) 11 - 16.5 weeks - 2.4 sq. ft. per bird

e) Turkey toms (five-stage program)
   1) 0 - 4 weeks - 0.5 sq. ft. per bird
   2) 4 - 8 weeks - 1.2 sq. ft. per bird
   3) 8 - 12 weeks - 2.1 sq. ft. per bird
   4) 12 - 16 weeks - 3.0 sq. ft. per bird
   5) 16 - 20 weeks - 4.0 sq. ft. per bird

NOTE: Use HO 4.1 for more details on housing for turkeys.

3. Poultry housing should provide the birds with a comfortable environment. Ask the students how the environment can affect poultry production and list on the board some of the environmental factors to consider when raising poultry.

**What are the key factors to consider when planning a brooding, grower or laying house?**

a) Considerations when planning a brooding or grower house
   1) How many chicks will be grown out each year?
   2) How favorable for production of poultry are the local climatic conditions?

UNIT - POULTRY PRODUCTION

Lesson 4: Housing and Equipment for Poultry

TEACHING PROCEDURES

A. Review

Review the previous lesson.

B. Motivation

Bring a laying cage to class and ask the students how many hens the cage can accommodate. Ask the students to estimate the space a caged hen requires. Calculate with the students the volume of the cage and compare that amount to the estimate.

C. Assignment

D. Supervised Study

E. Discussion

1. Birds have a greater ratio of body area to body volume than do most other animals. How do the feathers covering a bird's body protect it from exposure?

   **What are the basic types of poultry housing?**

   a) Laying houses
      1) Cage system of management
      2) Floor system of management
   b) Brooding houses - for brooding chicks
   c) Grower houses - to grow out broilers and replacements

2. Ask the students why a brooder guard is used to keep chicks in the general area of the hover. Why is space provided just beyond the hover limits?

   **What are the space requirements for birds of different ages?**

   a) Chicks
      1) First month - three-fourths of a square foot of floor space and 7 to 9 square inches of hover space
      2) After the first month - 1 square foot

b) Broilers
   1) Seven-tenths to eight-tenths square feet of floor space in the winter
   2) One square foot recommended in the summer

c) Layers
   1) Caged
      (a) Three birds per cage is recommended.
      (b) Each bird should have 54 to 64 square inches of cage space.
   2) Floor
      (a) For the light breeds provide 1 1/2 to 2 square feet of floor space for each bird.
      (b) For the heavy breeds provide 2 1/2 to 3 square feet of floor space or more for each bird. (Provide 1 1/2 square feet per bird for the heavy breeds under the following conditions.)
         (1) Feeders and waterers are placed in the roost area.
         (2) Hens are beak-trimmed to control cannibalism.
         (3) Birds are provided with adequate feeder space and rations.

d) Turkey hens (three-stage program)
   1) 0 - 5.5 weeks - 0.6 sq. ft. per bird
   2) 5.5 - 11 weeks - 1.2 sq. ft. per bird
   3) 11 - 16.5 weeks - 2.4 sq. ft. per bird

e) Turkey toms (five-stage program)
   1) 0 - 4 weeks - 0.5 sq. ft. per bird
   2) 4 - 8 weeks - 1.2 sq. ft. per bird
   3) 8 - 12 weeks - 2.1 sq. ft. per bird
   4) 12 - 16 weeks - 3.0 sq. ft. per bird
   5) 16 - 20 weeks - 4.0 sq. ft. per bird

NOTE: Use HO 4.1 for more details on housing for turkeys.

3. Poultry housing should provide the birds with a comfortable environment. Ask the students how the environment can affect poultry production and list on the board some of the environmental factors to consider when raising poultry.

**What are the key factors to consider when planning a brooding, grower or laying house?**

a) Considerations when planning a brooding or grower house
   1) How many chicks will be grown out each year?
   2) How favorable for production of poultry are the local climatic conditions?

3) Will the facility be tightly constructed, yet properly ventilated?
4) Will cleaning and disinfecting the floors and walls of the facility be possible?

b) Considerations when planning a laying house
1) How much space do the hens need?
2) What type of floor will be the best choice?
3) Where in the laying house and how large will the nests be?
4) What types of watering and feeding equipment will be the best choice?
5) How will the laying house be ventilated?
6) What amount of insulation in the structure
7) What type of lighting will be the best choice?

4. Ask the students to describe the types of equipment being used in local poultry operations. Then have the students explain some reasons behind a poultry producer's selection of equipment.

**What are the options when selecting equipment for a poultry operation?**

a) Litter, wire mesh or slat floor
1) Litter
(a) Has an insulating effect
(b) Wood shavings, ground corncobs, peanut shells, sugarcane fiber, hay chaff or peat moss
(c) Should be stirred frequently
(1) Prevents matting
(2) Will stay drier
2) Wire mesh or slat floors
(a) More heat required
(b) Humidity usually higher
(c) Easier to clean
(e) Birds tend to be nervous

b) Hand-fill, automatic or mechanical waterers and feeders
1) Provide birds with an ample supply of clean water at all times.
(a) Two 5-gallon fountains or a 4-foot automatic watering trough accommodates 100 chickens.
(b) Four 8-foot trough-type, mechanical waterers accommodate 100 chickens.
2) Provide each laying hen with a minimum of 5 inches of feeder space.
3) Feed should be no higher than the bird's shoulder height.

c) Adjustable slot, roof or forced-air ventilation systems.
   1) To provide fresh air for the birds
   2) To remove moisture given off by breathing and droppings
d) Artificial or natural light
   1) Laying hens should have a day of 14 to 17 hours.
   2) Artificial lighting, when used, is recommended for the morning.
      (a) Use one 60-watt bulb for every 200 square feet of floor space.
      (b) Avoid shading the feeders.
e) Coal, oil, gas or electric heat
f) Cage or traditional housing for layers
   1) Both require similar housing conditions.
   2) Cages are usually placed in rows, either single, double-decked or tiered.
g) Movable (colony) or permanent brooding houses
h) Turkeys grown out in permanent houses, on the range, or in pole sheds

F. Other Activities

1. Show the filmstrip "Small Flock Brooding Techniques," available from the Missouri Vocational Resource Center, 10 Industrial Education Building, UMC.

2. Visit a local brooding or laying enterprise.

3. Obtain extension literature or illustrated texts about agricultural structures to show the variety of poultry housing.

4. Design a simple poultry house with the students.

G. Conclusion

Properly managed poultry housing and equipment provide fresh air and water; a dry, warm environment; and a well-balanced diet. Emphasize that housing and equipment should serve the bird by providing comfort and a minimum of stress for optimal production from the flock.

H. Competency

Plan housing and equipment for raising poultry.

I. Answers to Evaluation

1. a. laying houses
   b. brooding houses
   c. grower houses
2. b. 1 square foot

3. Poultry require more space in the summer to avoid overheating.

4. b. 54 to 64 square inches

5. Answers should include three of the following:

   Number of chicks grown out each year
   Local climate
   Tight construction, yet proper ventilation
   Floors and walls that can be cleaned and disinfected

6. Answers should include four of the following:

   Amount of space needed by hens
   Type of floor most suitable for the operation
   Location and size of the nests
   Types of watering and feeding equipment most suitable for the operation
   Type of ventilation
   Amount of insulation in the structure
   Type of lighting

7. Prevent matting by stirring litter frequently.

8. (+) easier to clean
   (-) more heat required
   (-) humidity usually higher
   (-) birds tend to be nervous

9. b. 5 inches

10. a. ample
    b. shoulder
    c. day
    d. morning

UNIT - POULTRY PRODUCTION Name_____

Lesson 4: Housing and Equipment for Poultry Date_____

EVALUATION

1. List the three basic types of poultry houses.

   a.
   b.
   c.

2. The space requirement for a chick following its first month of growth is _____.

   a. 3/4 square foot
   b. 1 square foot
   c. 1 1/2 square
   d. 2 square feet

3. Explain why more floor space is recommended for broilers in summer than in winter.

4. Which of the following is the recommended space requirement of a caged layer? (Circle the best choice)

   a. 44 to 64 square inches
   b. 54 to 64 square inches
   c. 54 to 74 square inches
   d. 44 to 54 square inches

5. List three factors to consider when planning a brooding or grower house.

   a.
   b.
   c.

6. List four factors to consider when planning a laying house.

   a.
   b.
   c.
   d.

7. Explain how matting can be prevented when using a litter floor in a poultry house.

8. List one positive (labeled +) and one negative (labeled -) aspect of using a wire mesh floor in a poultry house.

   a. +
   b. -

9. The recommended minimum feeder space for a hen is _____.

   a. 3 inches
   b. 5 inches
   c. 7 inches
   d. 9 inches

10. Make the following statements true by circling the correct word to complete each statement.

   a. Provide poultry with a/an (ample/minimal) supply of clean water at all times.
   b. Feed should be no higher than the bird's (shoulder/hock joint) height.
   c. Hens should have a (day/night) of 14 to 17 hours.
   d. Artificial lighting, when used, is recommended for the (morning/evening).

## Housing for Turkeys

Stage production has developed into the most economical method of raising turkeys in complete confinement. Hens are grown in three stages, being moved every 5 1/2 weeks to a larger area. A five-stage program has been designed for toms because they grow faster than hens. The toms are moved every four weeks in such a program. Since toms are kept longer, become twice as large as hens, and are more aggressive, it is advisable to raise them in smaller size flocks.

Space requirements for hens and toms are summarized as follows:

HENS GROWN ON A THREE-STAGE PROGRAM

| Age in weeks | Floor space per hen | Feeder space per hen | Waterer space per hen |
|---|---|---|---|
| 0 - 5.5 | 0.6 sq. ft. | 1.50 in. | 0.5 in. |
| 5.5 - 11 | 1.2 sq. ft. | 0.75 in. | 0.5 in. |
| 11 - 16.5 | 2.4 sq. ft. | 0.75 in. | 0.5 in. |

TOMS GROWN ON A FIVE-STAGE PROGRAM

| Age in weeks | Floor space per tom | Feeder space per tom | Waterer space per tom |
|---|---|---|---|
| 0 - 4 | 0.5 sq. ft. | 1.50 in. | 0.5 in. |
| 4 - 8 | 1.2 sq. ft. | 0.75 in. | 0.5 in. |
| 8 - 12 | 2.1 sq. ft. | 0.75 in. | 0.75 in. |
| 12 - 16 | 3.0 sq. ft. | 1.50 in. | 0.75 in. |
| 16 - 20 | 4.0 sq. ft. | 1.50 in. | 1.00 in. |

FIGURE 4.1 Basic design of a three-stage growing building for 10,000 hens.

| Brood | Rear | Finish |
|---|---|---|
| 0 - 5.5 weeks | 5.5 - 11 weeks | 11 - 16.5 weeks |
| 6,000 sq. ft. | 12,000 sq. ft. | 24,000 sq. ft. |

In reference to Figure 4.1 after hens are marketed out of the finishing end the hens from the rearing section are moved into the finishing section and those in the brooding section are moved into the rearing section. Day-old poults can then be started in the brooding section. To move turkeys with this kind of arrangement, lights are left on in the section in which the birds are to be moved and off in the section from which they are being moved. Done overnight, by morning most of the birds will have moved into the new section.

Figure 4.2 (below) illustrates a similar scheme used for toms. Units in three-stage or five-stage growing buildings are operated separately, each unit having its own feeding, heating and ventilation systems. The units are attached only for the convenience of moving birds from one unit to the next with a minimum of stress placed on the birds.

FIGURE 4.2 Basic design of a five-stage growing building for 5,000 toms.

| Brood | Brood | Rear | Develop | Finish |
|---|---|---|---|---|
| 0 - 4 weeks | 4 - 8 weeks | 8 - 12 weeks | 12 - 16 weeks | 16 - 20 weeks |
| 2,500 sq. ft. | 6,000 sq. ft. | 10,000 sq. ft. | 15,000 sq. ft. | 20,000 sq. ft. |

Credit: Berg and Halverson. "The Turkey Management Guide." St.Paul, MN: Minnesota Turkey Growers Association, 1985, pages 25-27.

UNIT - POULTRY PRODUCTION

Lesson 5: Maintaining Flock Health

Objective: The student will explain the steps and health benefits of properly preparing and maintaining poultry facilities.

Study Questions

1. **How are facilities prepared for new birds?**

2. **What are the major diseases of poultry, and how are they controlled?**

3. **What are the major parasites of poultry, and how are they controlled?**

4. **How is litter managed for poultry?**

References

1. Livestock and Poultry Production, 5th edition, Bundy, Diggins and Christensen, Chapter 39, "Disease and Parasite Control," pages 597-608; Chapter 36, "Feeding and Management of the Laying Flock," page 554; Chapter 37 "Feeding of Young Chickens," page 569; and Chapter 38, "Turkey Production and Management," page 583

2. Poultry Science and Production, Moreng and Avens, Chapter 8, "Management for Disease Control," pages 235-256 (optional)

3. Poultry Production, Neshiem, Austic and Card, Chapter 10, "Diseases and Parasites," pages 253-284 (optional)

4. Insect Control Recommendations, UMC Extension Division, 1985 (optional)

5. Salsbury Manual of Poultry Diseases, 7th edition, Salsbury Laboratories Inc., Charles City, Iowa (optional)

6. Handouts

   a) HO 5.1: Poultry Diseases
   b) HO 5.2: Poultry Parasites

UNIT - POULTRY PRODUCTION

Lesson 5: Maintaining Flock Health

TEACHING PROCEDURES

A. Review

Review the previous lesson.

B. Motivation

Review a flock's vaccination schedule to illustrate for the students how chicks, growing birds and adult birds are protected from disease. Ask the students why timely and carefully administered vaccinations and approved drugs are important in poultry production.

C. Assignment

D. Supervised Study

E. Discussion

1. Ask the students what factors outside the poultry facility can lead to contamination of the flock. What conditions inside the facility favor contamination? List these factors and conditions on the chalkboard.

**How are facilities prepared for new birds?**

a) Start preparing the facility a few weeks before new birds arrive.
b) Remove all old litter.
c) Sweep and/or scrape the dropping pits, floor, nests, walls, roosts, ceiling and equipment. A blower may also be used to remove dust from the ceiling.
d) Scrub the facility's interior and all equipment with hot water and soap. Then disinfect and rinse.
e) Allow the facility to dry.
f) Make sure the feeders and waterers are cleaned and in working condition.
g) Provide clean nesting materials for layers.
h) Put down fresh litter.

NOTE: Take care in selecting litter for poults; they may eat litter for the first week to ten days.

i) Set up the brooder and put it into operation a few days before the chicks or poults arrive.

NOTE: The temperature 2 inches above the litter near the hover's edge should be from 90F to 95F the first week. Gradually reduce the temperature about 5F each week until reaching 70F.

2. Ask the students to help define the following terms: 1) disease, 2) immunity and 3) vaccine. Disease is any deviation from a normal state of good health. Immunity refers to the power to resist and overcome disease. Vaccines are used to help produce immunity and thus help prevent disease. Why is disease prevention so heavily stressed in poultry production? (HO 5.1)

**What are the major diseases of poultry, and how are they controlled?**

a) Bacterial diseases
   1) Salmonella infections (Pullorum, Fowl Typhoid, Paratyphoids)
      (a) Affect most domesticated poultry
      (b) Control
         (1) Blood test the entire breeding flock to eliminate carrier birds.
         (2) Purchase chicks from blood-tested sources only.
   2) Fowl Cholera
      (a) Especially serious in turkeys, but almost all other birds susceptible
      (b) Control
         (1) Practice good sanitation.
         (2) Isolate flock from wild animals and birds.
         (3) Use appropriate vaccines.
   3) Infectious Coryza (Roup)
      (a) Mostly affects aged, adult chickens
      (b) Control
         (1) Isolate birds of different ages from one another.
         (2) Practice good sanitation.
         (3) Eliminate mechanical distribution from infected to non-infected birds.
         (4) Vaccinate.

b) Virus diseases (many also called respiratory diseases)
   1) Avian Influenza (Fowl Plague)
      (a) Affects all domesticated poultry
      (b) Control
         (1) Place a quarantine on infected

flocks and areas.
(2) Practice good sanitation.
(3) Vaccinations are not always effective.

2) Fowl Pox
(a) Affects many species - especially serious in chickens and turkeys
(b) Controlled by vaccinating - very effective

3) Infectious Bronchitis
(a) Especially serious in chickens
(b) Control
(1) Use a vaccination program.
(2) Once established, the disease is difficult to control.

4) Newcastle Disease
(a) Affects chickens and turkeys
(b) Control
(1) Use a vaccination program.
(2) Practice good sanitation.
(3) Isolate the infected flock.

5) Marek's Disease (also called Fowl Paralysis, Leukosis, Range Paralysis)
(a) Mostly affects chickens (growing pullets and broilers under 16 weeks of age)
(b) Controlled by vaccinating at one day of age for lifetime protection

c) Mycoplasmosis Diseases (caused by bacteria-like microorganisms)

1) Mycoplasma Gallisepticum infections (MG, Chronic Respiratory Disease, Air Sac Disease)
(a) Affect chickens, turkeys and some species of game birds
(b) Control
(1) Practice good sanitation and management.
(2) Start with chicks and poults from known MG-free sources.
(3) Vaccinations give immediate success.

2) Mycoplasma Synoviae (MS, Synovitis, Large Hock Disease)
(a) Affects turkeys and chickens
(b) Control
(1) Blood test breeder flocks.
(2) Use same controls as for MG.

3) Mycoplasm Meleagridis (MM)
(a) Affects turkeys
(b) Control
(1) Avoid general transmissions through semen during artificial insemination.

(2) Develop and maintain MM-free flocks.
(3) Practice good sanitation.
(4) Excellent management is a necessity.

d) Coccidia-caused disease
1) Caused by a single-celled microorganism (host specific - different species of coccidia affect different birds and animals)
2) Coccidiosis
(a) Affects most species of domesticated poultry
(b) Control
(1) Practice good sanitation.
(2) Keep litter dry.
(3) Using coccidiostat drugs may be very effective in preventing serious outbreaks and in helping birds develop natural immunity.

e) Protozoan disease - Blackhead
1) Affects mainly turkeys, sometimes other species of birds
2) Control
(a) Control cecal worm.
(b) Clean ranges and buildings.
(c) Separate flocks of different ages.
(d) Raise chickens and turkeys separately.
(e) Practice good litter management.
(f) Use preventative drugs.

f) Fungus disease - Aspergiliosis (Brooder pneumonia)
1) Affects turkeys and chickens
2) Control
(a) Use sanitation programs in the hatchery.
(b) Use good quality feed.
(c) Practice good litter management.
(d) Use mold inhibitors in the feed, water and cleaning agents.

3. Parasites are disease-causing microorganisms that enter a bird's body through the skin, eyes, mouth, nasal passages and digestive system. Parasites may also live on a bird's skin surface and feathers. What are some of the ways parasites cause health problems in birds? Discuss this with the class. (HO 5.2)

**What are the major parasites of poultry, and how are they controlled?**

a) Internal parasites - affect most types of domesticated poultry
1) Large roundworms

(a) Use a regular worming schedule where problems have existed.
(b) Good litter management and clean ranges are helpful.
(c) Avoid overcrowding.
(d) Practice good flock management and sanitation.

2) Tapeworms
(a) Control is same as for roundworms.
(b) Also control intermediate hosts.

3) Cecal worms - control same as for roundworms

b) External parasites - affect most types of domesticated poultry

1) Bedbugs
(a) Control by isolating infected flocks and areas.
(b) Practice good sanitation.
(c) Direct control at house.

2) Lice - body louse, head louse, fluff louse
(a) Control by practicing good sanitation.
(b) Direct control at bird.

3) Northern fowl mite
(a) Control by practicing good sanitation.
(b) Direct control at bird.

4) Poultry mite
(a) Control by practicing good sanitation.
(b) Direct control at house.

5) Scaly-leg mite - controlled by practicing good sanitation

4. Ask the students how proper litter management helps prevent the occurrence of disease in the poultry flock.

**How is litter managed for poultry?**

a) Deep litter system for the laying flock

1) Place 4 to 6 inches of fresh litter on the floor of the laying house.
2) Spread litter evenly.
3) Replace wet litter as it accumulates around waterer.
4) Add 1 pound of hydrated lime to 10 square feet of floor space to aid microorganism action and reduce dampness.
5) Allow litter to build up with droppings and additional litter until it is 8 to 12 inches deep.

b) Litter for young chickens

1) Litter should be fairly coarse to permit droppings to sift through to the floor.
2) Place 3 to 4 inches of litter on the floor a day or two before the chicks arrive.

3) Pile litter in the corners to prevent crowding and injury.
4) Stir litter two to three times per week.
5) Place new litter on top of old, until a depth of 6 to 8 inches is reached.

c) Litter for turkeys
1) Poults may eat litter for first week or 10 days.
2) Many growers use a rough-surfaced litter paper the first week.
3) Coarse litter with particles 1/4 inch or more in diameter is desirable.
4) Start with litter 2 to 4 inches deep.

F. Other Activities

1. Have a poultry producer discuss with the students preparing poultry facilities for new birds.

2. Use slides, pictures in texts, magazines or extension bulletins to illustrate the symptoms of poultry diseases and parasites.

3. Invite a veterinarian or commercial poultry producer to discuss maintaining poultry flock health with the students.

4. Collect samples of locally available litter materials and compare their cost and desirability as a litter for chickens, turkeys or other fowl.

G. Conclusion

Emphasize that the labels on antibiotic, vaccine and other medication packages should always be read carefully and the contents must be used only as directed. Many diseases have similar symptoms but different treatments. Therefore, promptly identifying a disease is economically important for a poultry producer.

H. Competency

Describe procedures for promoting flock health and sanitation.

I. Answers to Evaluation

1. Answer should include one of the following:

   Facility must be scrubbed, disinfected and dried out.
   Time is needed to put down new litter.
   Time is needed to check that equipment is functioning properly.

2. a. 4
   b. 3
   c. 6
   d. 5
   e. 1

3. a, c, d, f

4. Answers should include at least two of the following:

   Puncture wounds on skin
   Ruffled feathers
   Pale appearance
   Production decreases
   Droopiness
   Listlessness

5. a. Use a fairly coarse litter.
   b. Place 3 to 4 inches of litter on the floor a day or two before the chicks arrive.
   c. Pile litter in the corners to prevent crowding and injury.
   d. Stir litter two to three times per week.
   e. Place new litter on top of old, to a depth of 6 to 8 inches.

UNIT - POULTRY PRODUCTION Name_____

Lesson 5: Maintaining Flock Health Date_____

EVALUATION

1. Explain one reason why preparation of a poultry facility begins a few weeks before new birds arrive.

2. Column A contains methods of controlling diseases in poultry. Column B contains names of poultry diseases. Select the disease in Column B that matches the method of control in Column A. Place the letter of the best choice in the space provided beside each method of control.

| A | | B |
|---|---|---|
| a. _____ | Quarantine infected flocks and areas. | 1. Blackhead |
| b. _____ | Vaccinate flock - very effective. | 2. Salmonella infections |
| c. _____ | Use mold inhibitors in the feed, water and cleaning agents. | 3. Fowl Pox |
| d. _____ | Avoid venereal transmission during artificial insemination. | 4. Avian Influenza |
| e. _____ | Control cecal worm. | 5. Mycoplasma Meleagridis (MM) |
| | | 6. Aspergillosis |
| | | 7. Coccidiosis |

3. Large roundworms, tapeworms and cecal worms are controlled in poultry by doing which of the following? (Circle all that apply.)

a. Clean ranges.
b. Blood test the breeding flock.
c. Practice good litter management.
d. Use regular worming schedules where problems have existed.
e. Use appropriate vaccines.
f. Practice good flock management.

4. List two symptoms of poultry having external parasites

a.
b.

5. Suppose that the 100 chicks ordered for your brooding house are arriving in three days. Briefly outline a litter management program for these chicks.

## POULTRY DISEASES

A. Bacterial diseases
   1. Salmonella infections (Pullorum, Fowl Typhoid, Paratyphoids)
      a) Affect most domesticated poultry
      b) Control
         1) Blood test the entire breeding flock to eliminate carrier birds.
         2) Purchase chicks from blood-tested sources only.
   2. Fowl Cholera
      a) Especially serious in turkeys, but almost all other birds susceptible
      b) Control
         1) Practice good sanitation.
         2) Isolate flock from wild animals and birds.
         3) Use appropriate vaccines.
   3. Infectious Coryza (Roup)
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         1) Isolate birds of different ages from one another.
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   1. Avian Influenza (Fowl Plague)
      a) Affects all domesticated poultry
      b) Control
         1) Place a quarantine on infected flocks and areas.
         2) Practice good sanitation.
         3) Vaccinations are not always effective.
   2. Fowl Pox
      a) Affects many species - especially serious in chickens and turkeys
      b) Control by vaccinating - very effective
   3. Infectious Bronchitis
      a) Especially serious in chickens
      b) Control
         1) Use a vaccination program.
         2) Once established, the disease is difficult to control.
   4. Newcastle Disease
      a) Affects chickens and turkeys
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    a) Mostly affects chickens - growing pullets and broilers under 16 weeks of age
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C. Mycoplasmosis Diseases (caused by bacteria-like microorganisms)
1. Mycoplasma Gallisepticum infections (MG, Chronic Respiratory Disease, Air Sac Disease)
    a) Affect chickens, turkeys and some species of game birds
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        1) Practice good sanitation and management.
        2) Start with chicks and poults from known MG-free sources.
        3) Vaccinations give immediate success.
2. Mycoplasma Synoviae (MS, Synovitis, Large Hock Disease)
    a) Affects turkeys and chickens
    b) Control
        1) Blood test breeder flocks.
        2) Use same controls as for MG.
3. Mycoplasm Meleagridis (MM)
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    b) Control
        1) Avoid general transmissions through semen during artificial insemination.
        2) Develop and maintain MM-free flocks.
        3) Practice good sanitation.
        4) Excellent management is a necessity.

D. Coccidia-caused disease
1. Caused by a single-celled microorganism (host specific - different species of coccidia affect different birds and animals)
2. Coccidiosis
    a) Affects most species of domesticated poultry
    b) Control
        1) Practice good sanitation.
        2) Keep litter dry.
        3) Using coccidiostat drugs may be very effective in preventing serious outbreaks and in helping birds develop natural immunity.

E. Protozoan disease - Blackhead
1. Affects mainly turkeys, sometimes other species of birds
2. Control
    a) Control cecal worm.
    b) Clean ranges and buildings.
    c) Separate flocks of different ages.
    d) Raise chickens and turkeys separately.
    e) Practice good litter management.
    f) Use preventative drugs.

F. Fungus disease - Aspergiliosis (Brooder pneumonia)
   1. Affects turkeys and chickens
   2. Control
      a) Use sanitation programs in the hatchery.
      b) Use good quality feed.
      c) Practice good litter management.
      d) Use mold inhibitors in the feed, water and cleaning agents.

## POULTRY PARASITES

A. Internal parasites - affect most types of domesticated poultry
   1. Large roundworms
      a) Use a regular worming schedule where problems have existed.
      b) Good litter management and clean ranges are helpful.
      c) Avoid overcrowding.
      d) Practice good flock management and sanitation.
   2. Tapeworms
      a) Control is same as for roundworms.
      b) Also control intermediate hosts.
   3. Cecal worms - control same as for roundworms

B. External parasites - affect most types of domesticated poultry
   1. Bedbugs
      a) Control by isolating infected flocks and areas.
      b) Practice good sanitation.
      c) Direct control at house.
   2. Lice - body louse, head louse, fluff louse
      a) Control by practicing good sanitation.
      b) Direct control at bird.
   3. Northern fowl mite
      a) Control by practicing good sanitation.
      b) Direct control at bird.
   4. Poultry mite
      a) Control by practicing good sanitation.
      b) Direct control at house.
   5. Scaly-leg mite - controlled by practicing good sanitation

UNIT - POULTRY PRODUCTION

Lesson 6: Marketing Poultry and Eggs

Objective: The student will describe the processes and important factors to consider in marketing poultry products.

Study Questions

1. **What are the four main factors to consider in marketing poultry products?**

2. **What marketing channels are available for eggs and poultry?**

3. **How is egg quality determined?**

4. **How are grades of dressed birds determined?**

References

1. Livestock and Poultry Production, 5th Edition, Bundy, Diggins, and Christensen, Chapter 40, "Marketing Poultry Products," pages 610-623

2. Poultry Production, Nesheim, Austic and Card, Chapter 11, "Marketing Eggs," pages 285-329; and Chapter 12, "Marketing Poultry," pages 330-354 (optional)

3. Poultry Science and Production, Moreng and Avens, Chapter 9, "Food Eggs and Egg Products," pages 257-283; and Chapter 10, "Poultry Meat and Meat Products," pages 285-343 (optional)

4. Handouts

   a) HO 6.1: Grading Eggs
   b) HO 6.2: Standards of Quality, Carcasses of Ready-to-Cook Poultry

5. Transparency Masters

   a) TM 6.1: Major Marketing Channels for Eggs, 1985
   b) TM 6.2: Major Marketing Channels for Ready-to-Cook Poultry, 1985-86

6. Slides

   a) Poultry Ready-to-Cook Carcass and Egg Quality

UNIT - POULTRY PRODUCTION

Lesson 6: Marketing Poultry and Eggs

TEACHING PROCEDURES

A. Review

Review the previous lesson.

B. Motivation

Have the students collect poultry product advertisements, write descriptions of commercials and record any other poultry marketing techniques that they observe. Collect your own examples: cassette recordings or videotaped commercials are suggested. Discuss with the students evidence of poultry marketing strategies in the samples.

C. Assignment

D. Supervised Study

E. Discussion

1. Discuss the high demand for turkeys at Thanksgiving to illustrate one factor that poultry producers must consider when marketing their product. How can these producers compensate for periods of low demand?

   **What are the four main factors to consider in marketing poultry products?**

   a) How to keep the volume of production in line with consumer demand
   b) How to plan production to market the products at the peak seasonal price
   c) How to produce the quality of products desired by the processor and consumer
   d) How to locate the best market

2. Ask the students to name the local marketing channels for commercially produced poultry and eggs. How do small-scale poultry producers market their products? (TM 6.1 and TM 6.2)

   **What marketing channels are available for eggs and poultry?**

   a) Domestic commercial egg producers supply eggs for
      1) Packing plants

2) Wholesale distributors
3) Food manufacturers
4) Retail outlets
5) Egg-product consumers
6) Institutions and restaurants
7) Shell egg consumers

b) Domestic commercial poultry processors slaughter birds for
1) Further processing
2) Exports and shipments
3) Wholesale distributors
4) Retailers
5) Institutional outlets and restaurants
6) Domestic consumers of whole or cut-up birds

3. Ask the students to state their preferences for eggs in the following categories: 1) brown or white; 2) small, medium or large; 3) clean or stained; and 4) normal or slightly abnormal in shape. Of what importance are handling and appearance in the marketing of eggs?

**How is egg quality determined?**

a) Main factors in determining the quality of an egg are the following.
1) Shell quality
2) Albumen quality
3) Condition of yolk
4) Absence of defects (blood and meat spots)

b) Commercially, egg quality is determined by candling.

c) The three United States consumer grades of eggs are the following.
1) AA quality
2) A quality
3) B quality

NOTE: Use HO 6.1 to provide more details on egg grading and HO 1.2 for information on egg candling.

4. Roleplay in the following situation with the students. "You are food shopping, and a whole ready-to-cook turkey is on your shopping list. The ungraded turkeys are marked $.69 per pound and A-quality turkeys are marked $.89 per pound. Will you buy the ungraded or A-quality bird, and what are the reasons for your selection?" What are some uses of turkeys where carcass grade is not of primary importance?

**How are grades of dressed birds determined?**

a) Conformation - normal, moderate and abnormal
b) Fleshing - well, moderately and poorly fleshed
c) Fat - well-covered, sufficient and lacking in fat
d) Pinfeathers - free, few scattered and scattering
e) Exposed flesh - resulting from cuts, tears and missing skin
f) Discolorations - blemishes and bruises of skin or flesh
g) Disjointed or broken bones and missing parts
h) Freezing defects - darkening, pock marks, clear or pinkish ice, and dried areas

NOTE: Use HO 6.2 to provide more details on grading a poultry carcass.

F. Other Activities

1. Sample with the students some of the new processed poultry products in class. These are products such as chicken patties, turkey ham, turkey hot dogs and cold cuts using poultry meat.

2. Show the students how to candle eggs.

3. Compare AA-quality, A-quality and B-quality eggs.

4. Use slides to illustrate for the students characteristics of the different grades of poultry.

5. Survey the supermarket for turkey and chicken products. Determine with the students what products contain poultry meat, how these products are packaged, what information is included on the label and whether the product is fresh or frozen.

G. Conclusion

Eggs and poultry meat are inexpensive, wholesome and nutritious protein sources. Emphasize that the poultry meat market is expanding by way of the development of further-processed products and that this expansion illustrates one facet of the economic potential of the poultry industry's future.

H. Competency

Describe various marketing channels for poultry and eggs.

I. Answers to Evaluation

1. a. demand
   b. price
   c. quality
   d. market

2. Answers should include five of the following:

   Packing or egg-grading plants
   Wholesale distributors
   Food manufacturers
   Retail outlets
   Egg product consumers
   Institutions and restaurants
   Shell egg consumers

3. Answers should include four of the following:

   Exports and shipments
   Wholesale distributors
   Retailers
   Institutional outlets and restaurants
   Domestic consumers of whole or cut-up birds

4. Shell, yolk

5. Eggs differ in quality or to help the consumer select the quality he or she wants.

6. Answers should include five of the following:

   Conformation
   Fleshing
   Fat covering
   Pinfeathers
   Exposed flesh (cuts and tears of the skin)
   Discolorations
   Disjointed or broken bones, missing parts
   Freezing defects

UNIT - POULTRY PRODUCTION Name_____

Lesson 6: Marketing Poultry and Eggs Date_____

EVALUATION

1. Complete the following considerations in marketing poultry products by writing the appropriate words in the blank spaces provided.

   a. Keep the volume of production in line with consumer _____.
   b. Plan production to market the products at peak seasonal _____.
   c. Produce the _____ of products desired by the processor and consumer.
   d. Locate the best _____.

2. List five marketing channels for commercially produced eggs.

   a.
   b.
   c.
   d.
   e.

3. List four marketing channels for ready-to-cook poultry.

   a.
   b.
   c.
   d.

4. The main factors used to determine the interior quality (or grade) of an egg are the _____ and albumen quality, condition of the _____ and absence of defects.

5. Explain one reason why eggs are given consumer grades in the United States.

6. List five factors used to determine the grade of a dressed, ready-to-cook turkey or broiler carcass.

   a.
   b.
   c.
   d.
   e.

# Grading Eggs

**Table 1 Summary of Standards for Exterior Quality of Eggs**

| Factor | Grade | | |
|---|---|---|---|
| | AA or A | B | Dirty |
| Stain | Clean—may show small specks, stains or cage marks that do not detract from general clean appearance of the egg—may show traces of processing oil. | Slight, or moderate localized stains less than 1/32 of shell or scattered stains less than 1/16 of shell. | Prominent stains. Moderate stains covering more than 1/32 if localized and 1/16 of the shell if scattered. |
| Adhering Dirt or Foreign Material | NONE | NONE | Adhering dirt or foreign material (1.0 mm in area or greater) |
| Egg Shape | Approximately the usual shape. | Unusual or decidedly misshapen (very long or distorted). | |
| Shell Texture | May have rough areas that do not materially affect shape or strength. | Extremely rough areas that may be faulty in soundness or strength. May have large calcium deposits. | |
| Ridges | Slight ridges that do not materially affect shape or strength. | May have pronounced ridges. | |
| Shell Thickness | Free from thin spots. | May show pronounced thin spots. | |

**Table 2 Summary of Standards for Interior Quality of Eggs by Candling**

| Quality Factor | AA Quality | A Quality | B Quality | Inedible |
|---|---|---|---|---|
| Air Cell | 1/8 inch or less in depth | 3/16 inch or less in depth | More than 3/16 inch | Doesn't apply |
| White | Clear Firm | Clear May be reasonably firm | Clear May be weak and watery | Doesn't apply |
| Yolk | Outline slightly defined | Outline may be fairly well-defined | Outline clearly visible | Doesn't apply |
| Spots (Blood or meat) | None | None | Blood or meat spots aggregating not more than 1/8" in diameter | Blood or meat spots aggregating more than 1/8" in diameter |

Source: Poultry Judging, Purdue University Cooperative Extension Service, West Lafayette, IN, pages 18-19



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# Standards of Quality for Ready-To-Cook Poultry Carcasses

## (Minimum Requirements and Maximum Defects Permitted)

| FACTOR | A QUALITY | | B QUALITY | | C QUALITY |
|---|---|---|---|---|---|
| CONFORMATION: | Normal | | Moderate deformities | | Abnormal |
| Breastbone | Slight curve or dent | | Moderately dented, curved, or crooked | | Seriously curved or crooked |
| Back | Normal (except slight curve) | | Moderately crooked | | Seriously crooked |
| Legs & Wings | Normal | | Moderately misshapen | | Misshapen |
| FLESHING: | Well fleshed; moderately long, deep, and rounded breast | | Moderately fleshed | | Poorly fleshed |
| FAT COVERING: | Well covered, especially between heavy feather tracts on breast | | Sufficient fat on breast and legs to prevent distinct appearance of flesh through the skin | | Lacking in fat covering over all parts of carcass |
| PINFEATHERS: | | | | | |
| Nonprotruding pins & hair | Free | | Few scattered | | Scattering |
| Protruding pins | Free | | Free | | Free |
| EXPOSED FLESH:[1] | Breast | | Breast | | |
| Carcass Weight | & Legs | Elsewhere | & Legs[2] | Elsewhere[2] | |
| Over 1½-6 lbs. | None | 1½" | 1½" | 3" | No limit |
| Over 6-16 lbs. | None | 2" | 2" | 4" | No limit |
| DISCOLORATIONS[3] | | | | | |
| Over 1½-6 lbs. | 1" | 2" | 2" | 3" | No limit[4] |
| Over 6-16 lbs. | 1½" | 2½" | 2½" | 4" | No limit[4] |
| DISJOINTED BONES | 1 | | 2 disjointed & no broken or | | No limit |
| BROKEN BONES | None | | 1 disjointed & 1 nonprotruding broken | | No limit |
| MISSING PARTS | Wing tips and tail | | Wing tips, 2nd wing joint, and tail | | Wing tips, wings, and tail |
| | | | Back area not wider than base of tail and extending half way between base of tail and hip joints | | Back area not wider than base of tail extending to area between hip joints |

[1] Total aggregate area of flesh exposed by all cuts, tears, and missing skin.

[2] A carcass meeting the requirements of A quality for fleshing may be trimmed to remove skin & flesh defects, provided no more than 1/3 of the flesh is exposed on any part & the meat yield is not appreciably affected.

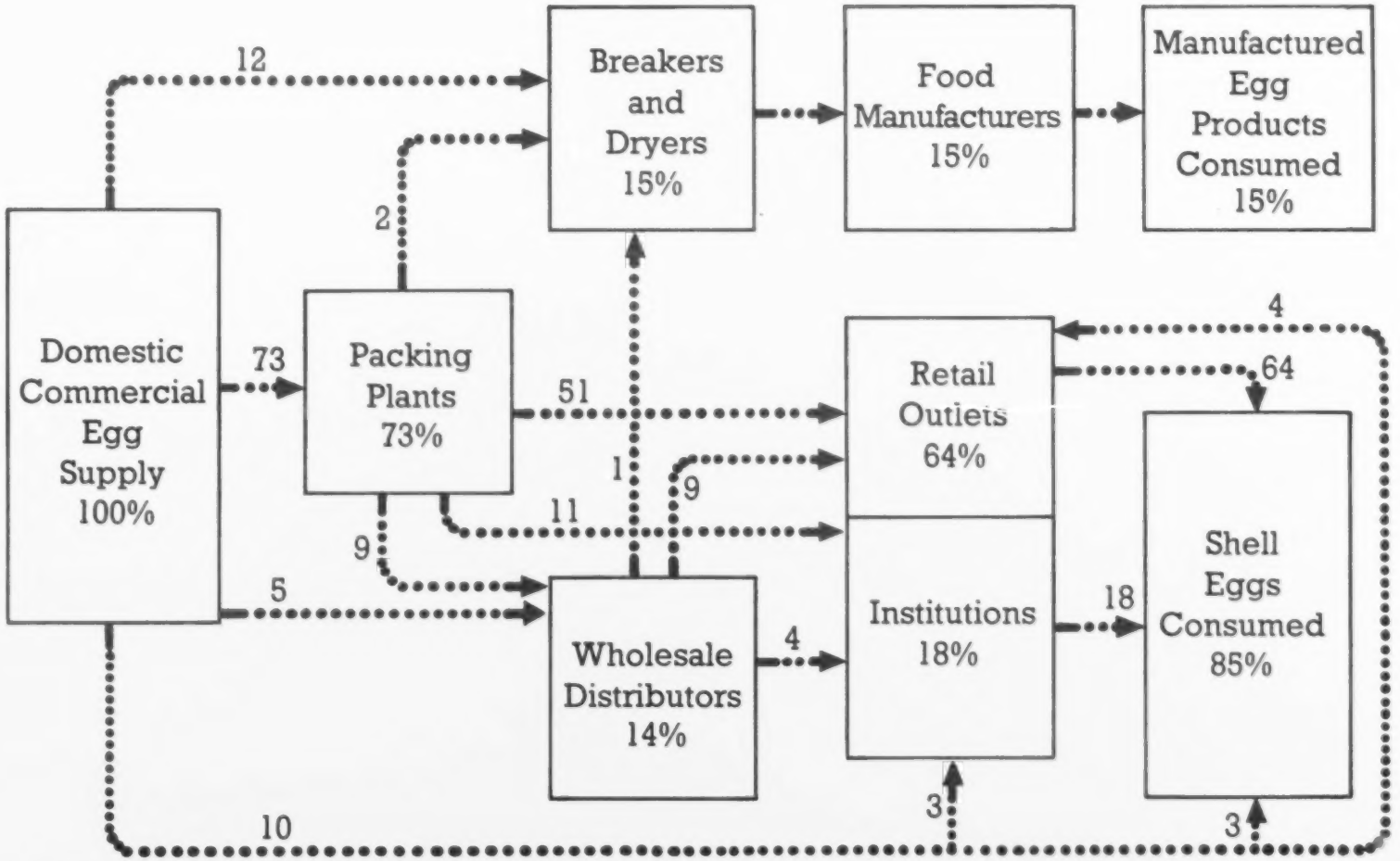
[3] Flesh bruises & discolorations such as "blue back" are not permitted on breast & legs of A quality birds. Not more than 1/2 of total aggregate area of discolorations may be due to flesh bruises or "blue back" (when permitted) & skin bruises in any combination.

[4] No limit on size & number of areas of discoloration & flesh bruises if such areas do not render any part of the carcass unfit for food.

* Adapted from Poultry Grading Manual - Agriculture Handbook No. 31.

Source: Poultry Grading Manual(Agricultural Handbook #31), U. S. D. A.

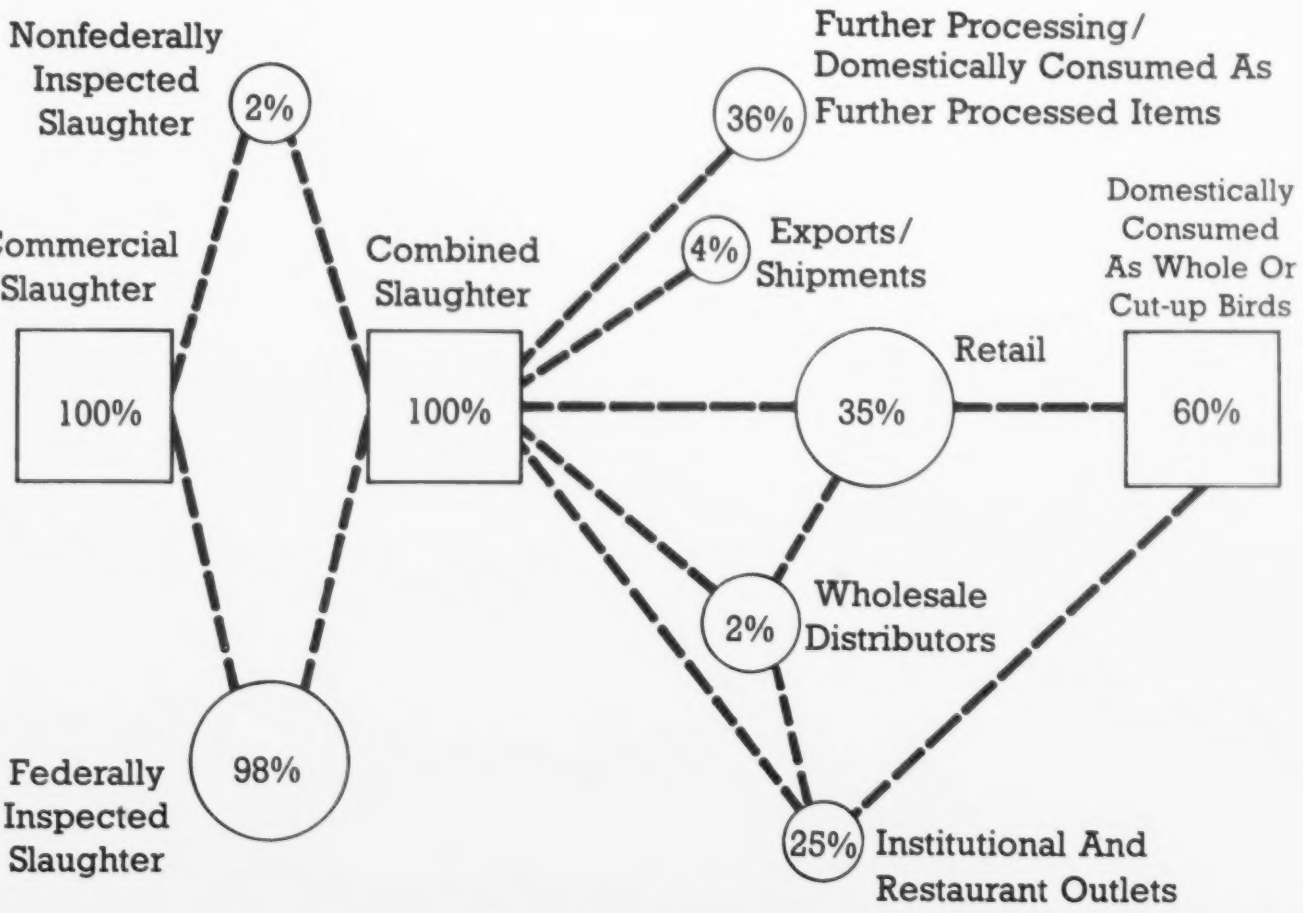
# Major Marketing Channels for Eggs, 1985*




*U.S. commercial marketing channels for eggs (as estimated for 1985 by UMC Extension Poultry Specialists). Note: this excludes exports and imports and eggs consumed on farms where produced. Also hatching eggs are not included.

TM 6.1

# Ready-To-Cook Poultry, 1985-86*




*U. S. commercial marketing channels for ready-to-cook poultry (as estimated for 1985-86 by UMC Extension Poultry Specialist) Note: This includes all types of ready-to-cook chicken (broilers, fowl, roasters, etc.) and turkeys. Ducks and geese are not included.

TM 6.2